

OFFICE OF
ENGINEERING
CONSTRUCTION
UNITED STATES ARMY
WASHINGTON, D. C.

ENGINEERS'
FIELD BOOK
No. 10403

10403
10403

EUGENE DIETZGEN CO.

DRAWING MATERIALS, MATHEMATICAL and
SURVEYING INSTRUMENTS

Chicago New York San Francisco New Orleans Pittsburg Toronto

Distances from Center of Roadway for Cross-Sectioning
Roadway 16 feet wide. Side Slopes 1 on 1.
For Single Track Embankment.

H	0	.1	.2	.3	.4	.5	.6	.7	.8	.9	H
0	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.8	8.9	0
1	9.0	9.1	9.2	9.3	9.4	9.5	9.6	9.7	9.8	9.9	1
2	10.0	10.1	10.2	10.3	10.4	10.5	10.6	10.7	10.8	10.9	2
3	11.0	11.1	11.2	11.3	11.4	11.5	11.6	11.7	11.8	11.9	3
4	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	12.9	4
5	13.0	13.1	13.2	13.3	13.4	13.5	13.6	13.7	13.8	13.9	5
6	14.0	14.1	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9	6
7	15.0	15.1	15.2	15.3	15.4	15.5	15.6	15.7	15.8	15.9	7
8	16.0	16.1	16.2	16.3	16.4	16.5	16.6	16.7	16.8	16.9	8
9	17.0	17.1	17.2	17.3	17.4	17.5	17.6	17.7	17.8	17.9	9
10	18.0	18.1	18.2	18.3	18.4	18.5	18.6	18.7	18.8	18.9	10
11	19.0	19.1	19.2	19.3	19.4	19.5	19.6	19.7	19.8	19.9	11
12	20.0	20.1	20.2	20.3	20.4	20.5	20.6	20.7	20.8	20.9	12
13	21.0	21.1	21.2	21.3	21.4	21.5	21.6	21.7	21.8	21.9	13
14	22.0	22.1	22.2	22.3	22.4	22.5	22.6	22.7	22.8	22.9	14
15	23.0	23.1	23.2	23.3	23.4	23.5	23.6	23.7	23.8	23.9	15
16	24.0	24.1	24.2	24.3	24.4	24.5	24.6	24.7	24.8	24.9	16
17	25.0	25.1	25.2	25.3	25.4	25.5	25.6	25.7	25.8	25.9	17
18	26.0	26.1	26.2	26.3	26.4	26.5	26.6	26.7	26.8	26.9	18
19	27.0	27.1	27.2	27.3	27.4	27.5	27.6	27.7	27.8	27.9	19
20	28.0	28.1	28.2	28.3	28.4	28.5	28.6	28.7	28.8	28.9	20
21	29.0	29.1	29.2	29.3	29.4	29.5	29.6	29.7	29.8	29.9	21
22	30.0	30.1	30.2	30.3	30.4	30.5	30.6	30.7	30.8	30.9	22
23	31.0	31.1	31.2	31.3	31.4	31.5	31.6	31.7	31.8	31.9	23
24	32.0	32.1	32.2	32.3	32.4	32.5	32.6	32.7	32.8	32.9	24
25	33.0	33.1	33.2	33.3	33.4	33.5	33.6	33.7	33.8	33.9	25
26	34.0	34.1	34.2	34.3	34.4	34.5	34.6	34.7	34.8	34.9	26
27	35.0	35.1	35.2	35.3	35.4	35.5	35.6	35.7	35.8	35.9	27
28	36.0	36.1	36.2	36.3	36.4	36.5	36.6	36.7	36.8	36.9	28
29	37.0	37.1	37.2	37.3	37.4	37.5	37.6	37.7	37.8	37.9	29
30	38.0	38.1	38.2	38.3	38.4	38.5	38.6	38.7	38.8	38.9	30
31	39.0	39.1	39.2	39.3	39.4	39.5	39.6	39.7	39.8	39.9	31
32	40.0	40.1	40.2	40.3	40.4	40.5	40.6	40.7	40.8	40.9	32
33	41.0	41.1	41.2	41.3	41.4	41.5	41.6	41.7	41.8	41.9	33
34	42.0	42.1	42.2	42.3	42.4	42.5	42.6	42.7	42.8	42.9	34
35	43.0	43.1	43.2	43.3	43.4	43.5	43.6	43.7	43.8	43.9	35
36	44.0	44.1	44.2	44.3	44.4	44.5	44.6	44.7	44.8	44.9	36
37	45.0	45.1	45.2	45.3	45.4	45.5	45.6	45.7	45.8	45.9	37
38	46.0	46.1	46.2	46.3	46.4	46.5	46.6	46.7	46.8	46.9	38
39	47.0	47.1	47.2	47.3	47.4	47.5	47.6	47.7	47.8	47.9	39
40	48.0	48.1	48.2	48.3	48.4	48.5	48.6	48.7	48.8	48.9	40

Example—If point is 22.6 ft. above grade, how far should it be from center line to be a slope stake point? Ans. from Table 30.6. For same slopes but other widths of roadbed, correct above figures by one-half difference in width of roadbed; thus in example above, for 20 ft. roadbed distance will be $30.6 + (20 - 16) \div 2$ or 2 ft. added to $30.6 = 32.6$. For slopes of 1 on $1\frac{1}{2}$ see inside of back cover.

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0 + 30² on Garage Floor 89.8

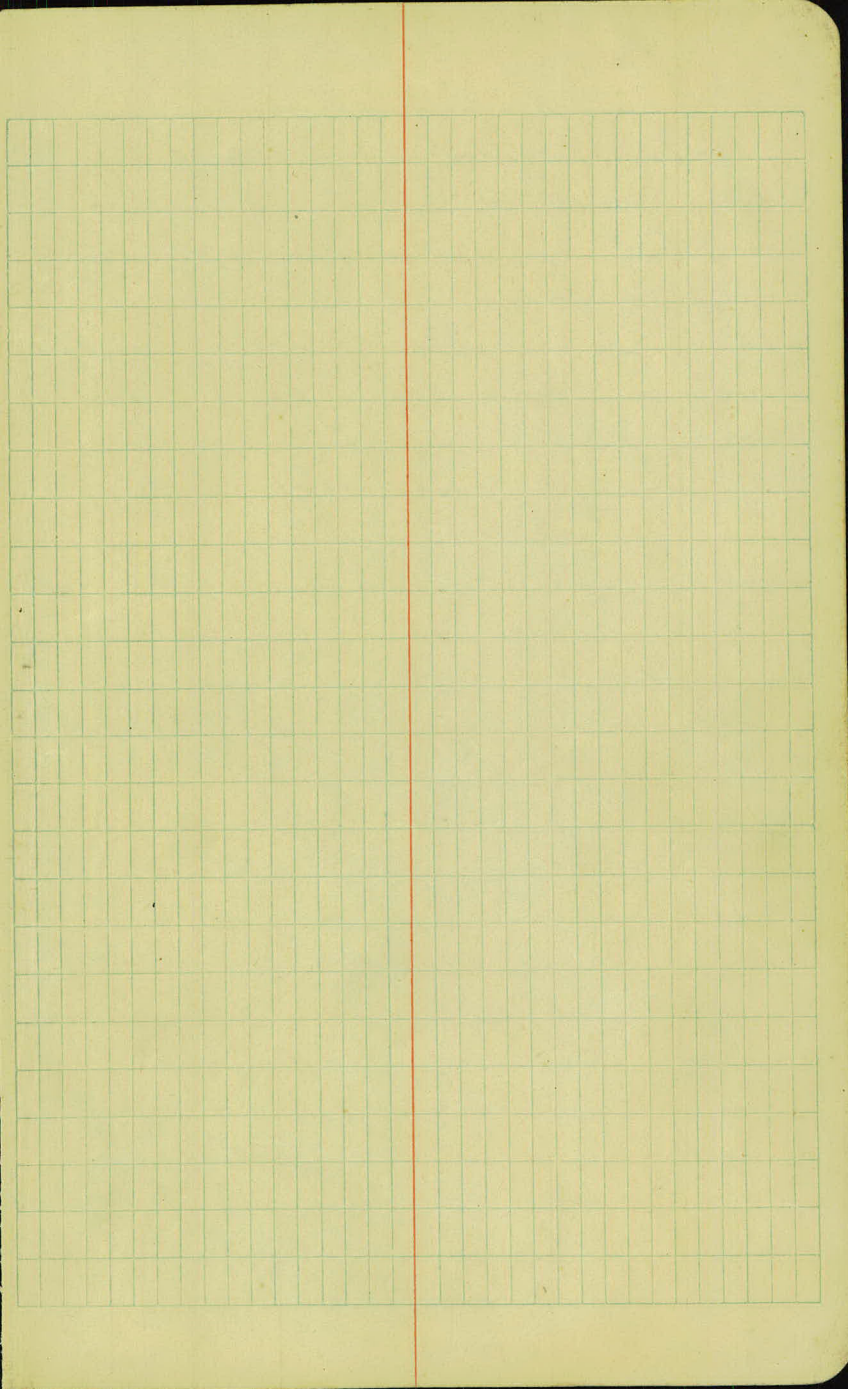
B.M. Spk. in Tree Lt. Sta. 3155. Elev. 89.35

Red
m

Office of Ramsey Co. Engineer
ST. PAUL, MINN.

Date Filed _____

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2

Station Ang. bt. Ang. Rt.
13+00.8 = $\frac{1}{2}$ Mpls Road.

11+51.70 P.T.

10+79.6 P.I. 29°40'

10+03⁴⁰ P.C.

6+75⁵² P.T.

4+92⁰⁹ P.I. 38°-14'

2+93²⁴ P.C.

0+00

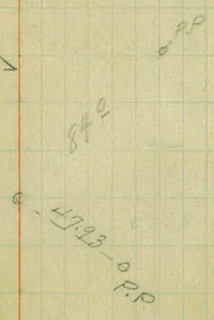
End. Bridge

5.10.15



Sta - Def
 10+03.4 - 0°00'
 +50 - 41°39.6'
 11+00 - 90°39.6'
 +51.7 - 140°50'

20° Curve ht
 $\Delta = 290.40'$
 Rad = 287.94
 Tang = 76.25
 length = 148.30



2+75²⁴
 3+00 - 0°20'
 +50 - 5°50' - 47-47'
 4+00 - 5°30'
 +50 - 5°47'
 +50 - 7°50'
 5+00 - 10°30'
 +50 - 12°50'
 6+00 - 15°30'
 +50 - 17°50'
 +75 - 19°07'

$\Delta = 38°-14'$
 D = 10° 17'
 T = 192 ⁵³
 L = 352 ³³



Point on Wall
 of Building



Sta.	+	HI.	-	Elev.
B.M.	0.52	111.32		110.80
B.M.			2.38	102.94
T.P.	5.73	110.08	6.97	104.35
B.M.			3.61	106.47
T.P.	5.58	113.59	2.07	108.01
B.M.			6.47	107.12, 107.12
B.M.			0.31	113.28

113.28
0.7
95

Top of Hyd. H. Sta. 3+50.

S.P.K. in 36" Tree 56' Lt. Sta. 3+03.

S.P.K. in P.P. 46' Rt. Sta. 7+52.

799.41 = Gov't Elev.

Nail in large Cottonwood 99' Lt. Sta. 13+48.6

S.P.K. in 24" Tree 102' Rt. Sta. 11+62.

Sta.	T.P.	HI		Elev.
	0.75	111.55		110.80
	1.07	100.17	12.45	99.10
6+00				103.4
	3.93	95.05	2.05	91.12
+40				103.7
+75 ^E				
7+00				104.2
+23				
	6.99	99.38	2.44	92.39
+50				104.6
8+00				105.0
	11.75	109.91	1.22	98.14
6+00				103.4
+40				103.7
+75 ^E				
7+00				104.2

Lt.

Rt.

Top of High Lt. Sta. 3450.

94	6.7	8.2	7.8	4.6
25	18	10	10.0	7

6.6	58	35.4	4.9	3.6	5.2	4.9	4.0
75	50	14.2	34	28	24	12.5	9

7.5	6.7	5.1	5.4	4.4
78	50	18		4

7.4	6.6	9.5.3	4.0	5.0	4.7	2.0
88	53	14.6	38	28	12.5	8

6.9	7.5	6.7	5.2	2.7	1.4
71	50	37	27		11

13.2	11.2	11.2	11.4	9.0	1.2	9.2
62	54	16.6	40	15	5.2	11

8.8	9.1	7.4	5.5	1.3
60	25	37	9	5.9

17.5	4.2	5.5.3	14.8
	20	11.0	32

19.8	5.0	5.0	4.6
	0.2	28	52

20.3	5.9	4.6	4.6
	25	31	34

19.3	4.7	4.3	4.2
	1.1	30	34

5+4	+	H.I	-	Elev
		109.91		

7+23

7+50				104.4
------	--	--	--	-------

8+00				105.0
------	--	--	--	-------

B.M.	3.23	109.70	3.43	106.48	106.47
------	------	--------	------	--------	--------

T.P.	1.34	98.47	12.57	97.13	
------	------	-------	-------	-------	--

+50				105.4
-----	--	--	--	-------

7+00				105.8
------	--	--	--	-------

T.P.	9.75	106.41	1.81	94.60	
------	------	--------	------	-------	--

+50				106.5
-----	--	--	--	-------

	1.33	102.90	4.78	101.63	
--	------	--------	------	--------	--

10+00				107.5
-------	--	--	--	-------

+15

*Hand
Red.*

+34

T.P.	7.07	110.33	1.70	101.24	
------	------	--------	------	--------	--

8+50				105.4
------	--	--	--	-------

7+00				105.8
------	--	--	--	-------

$$17.6 \quad \begin{array}{r} 4.3 \\ 30 \\ \hline \end{array} \quad \begin{array}{r} 4.1 \\ 34 \\ \hline \end{array} \quad \checkmark$$

$$11.7 \quad \begin{array}{r} 4.6 \\ 24 \\ \hline \end{array} \quad \begin{array}{r} 54.2 \\ 70.6 \\ \hline \end{array} \quad \begin{array}{r} 4.0 \\ 3.3 \\ \hline \end{array}$$

$$11.8 \quad \begin{array}{r} 5.0 \\ 12 \\ \hline \end{array} \quad \begin{array}{r} 51.4 \\ 124 \\ \hline \end{array} \quad \begin{array}{r} 2.9 \\ 3.5 \\ \hline \end{array}$$

3pt in P.P. 46 BA 579 7 + 5.2

$$94.0 \cdot$$

$$\begin{array}{r} 6.2 \\ 50 \\ \hline \end{array} \quad \begin{array}{r} 3 \\ 45 \\ \hline \end{array} \quad \begin{array}{r} 5.4 \\ 12.9 \\ \hline \end{array} \quad \begin{array}{r} 4.5 \\ 10.5 \\ \hline \end{array} \quad \begin{array}{r} 2.6 \\ 8 \\ \hline \end{array}$$

F104

$$96.9 \cdot$$

$$\begin{array}{r} 38.2 \\ 135 \\ \hline \end{array} \quad \begin{array}{r} 116 \\ 160 \\ \hline \end{array} \quad \begin{array}{r} 195.6 \\ 404 \\ \hline \end{array} \quad \begin{array}{r} 504 \\ 107 \\ \hline \end{array} \quad \begin{array}{r} 487 \\ 94 \\ \hline \end{array} \quad \begin{array}{r} 50 \\ 38 \\ \hline \end{array} \quad \begin{array}{r} 3.3 \\ 2.1 \\ \hline \end{array} \quad \begin{array}{r} 1.6 \\ -8.0 \\ \hline \end{array}$$

BM 46.54 = F104

F104

$$101.0$$

$$\begin{array}{r} 41.5 \\ 135 \\ \hline \end{array} \quad \begin{array}{r} 123 \\ 153 \\ \hline \end{array} \quad \begin{array}{r} 241.3 \\ 452 \\ \hline \end{array} \quad \begin{array}{r} 432 \\ 110 \\ \hline \end{array} \quad \begin{array}{r} 523 \\ 55 \\ \hline \end{array} \quad \begin{array}{r} 563 \\ 70 \\ \hline \end{array} \quad \begin{array}{r} 613 \\ 46 \\ \hline \end{array} \quad \begin{array}{r} 11.8 \\ 12 \\ \hline \end{array} \quad \begin{array}{r} 5.4 \\ -4.5 \\ \hline \end{array}$$

~~$$\begin{array}{r} 14.8 \\ 75 \\ \hline \end{array} \quad \begin{array}{r} 114 \\ 16.7 \\ \hline \end{array} \quad \begin{array}{r} 200 \\ 32 \\ \hline \end{array} \quad \begin{array}{r} 285 \\ 20 \\ \hline \end{array} \quad \begin{array}{r} 24 \\ 7 \\ \hline \end{array} \quad \begin{array}{r} 2.4 \\ -5.8 \\ \hline \end{array}$$~~

~~$$\begin{array}{r} 16.5 \\ 75 \\ \hline \end{array} \quad \begin{array}{r} 115 \\ 75 \\ \hline \end{array} \quad \begin{array}{r} 96 \\ 32 \\ \hline \end{array} \quad \begin{array}{r} 2.2 \\ 2.2 \\ \hline \end{array}$$

$$\begin{array}{r} 17.4 \\ 75 \\ \hline \end{array} \quad \begin{array}{r} 105 \\ 65 \\ \hline \end{array} \quad \begin{array}{r} 13.0 \\ 3 \\ \hline \end{array} \quad \begin{array}{r} 6.7 \\ 3.3 \\ \hline \end{array} \quad \begin{array}{r} 4.1 \\ 3.3 \\ \hline \end{array}$$~~

Vaid RPL

$$16.3 \quad \begin{array}{r} 5/5.6 \\ 11 \\ \hline \end{array} \quad \begin{array}{r} 7.5 \\ 3.3 \\ \hline \end{array}$$

$$13.4 \quad \begin{array}{r} 11.6 \\ 13 \\ \hline \end{array} \quad \begin{array}{r} 6/6.2 \\ 18 \\ \hline \end{array} \quad \begin{array}{r} 4.8 \\ 3.8 \\ \hline \end{array} \quad \begin{array}{r} 4.4 \\ 3.3 \\ \hline \end{array}$$

Sta.

+

H.I.

-

Elev.

110.33

9+50

1064

~~10+00~~

1073

~~715~~

~~734~~

B.M.

3.84

106.77

9.7

$$\begin{array}{r} 8.1 \\ 19 \overline{) 190} \\ \underline{190} \\ 0 \end{array}$$

$$\begin{array}{r} 6.1 \\ 10 \overline{) 61} \\ \underline{60} \\ 1 \end{array}$$

$$\begin{array}{r} 2.3 \\ 15 \overline{) 34.5} \\ \underline{30} \\ 4.5 \\ \underline{45} \\ 0 \end{array}$$

$$\begin{array}{r} 6.6 \\ 15 \overline{) 99} \\ \underline{90} \\ 9 \end{array}$$

Vaid
Rd.

SPK in P.P. 46 Rt. Sta 7+52.

Sta.	+	H.I.	-	Elev.
B.M.	1.85	112.65		110.80
0+00				9.14
+08 ⁵				9.09
+35				9.00
+45				9.05
+52				8.95
+79				8.9
1+00				8.0
+50				8.1
2+00				8.4
+50				8.3
+70				8.0
+72				8.0

LT

RT

Top of Hwy LA Sta. 9450 Top of Rail

528	303	362	347		354	362	304	324
33	176	176	8	3.51	8	175	175	33

41	35	38	352		357	356	355	
33	28	23	7.5	3.56	24	23	33	

43	39	41	39	357		365	39	34	34
33	30	25	17	33	3.65	144	14	27	33

47	41	38	40	40	355		374	39	36	36
33	24	21	20	13	46	3.60	122	29	30	33

48	43	40	40			363	37	393	40	37
33	20	14	10	3.70		3.5	14	134	33	37

43	41					375	38	390	41
33	14			3.8		224	37	458	33

47	47					44	42	42	40	39
33	18	4.7				10	11	13	31	37

43	45					45	43		
33	18	4.6				18	33		

41	42					45	46		
33	18	4.3				18	33		

45	45					44	46		
33	18	4.4				18	33		

48	46					46	47		
33	18	4.7				18	33		

48	46					47	48		
33	18	4.7				18	33		

Sta.	+ / -	H.I.	-	Elev.
		112.65		
B.M.	1.64	112.44	1.85	110.80
2+85				2.7
+87				2.5
3+00				2.5
+01				2.9
+03				8.0
		3+10	107.89	7.1 = 5.40 + 1.70 + 2.7
			19.5	
+14		3+10	107.75	" " " " " 8.4
			19.5	2.5
+18				2.5
+30				6.5
+50				4.3
				100.2
+68				2.5
+89				2.3
				105.4
+100				2.4
T.P.	5.04	105.91	9.57	102.87

LT

RT

$\frac{48}{40}$	$\frac{48}{33}$	$\frac{47}{18}$	4.7	$\frac{47}{18}$	$\frac{46}{33}$	$\frac{46}{40}$
-----------------	-----------------	-----------------	-----	-----------------	-----------------	-----------------

$\frac{49}{40}$	$\frac{49}{33}$	$\frac{49}{18}$	4.9	$\frac{48}{18}$	$\frac{47}{33}$	$\frac{47}{40}$
-----------------	-----------------	-----------------	-----	-----------------	-----------------	-----------------

$\frac{47}{40}$	$\frac{48}{33}$	$\frac{48}{18}$	4.9	$\frac{49}{18}$	$\frac{49}{33}$	$\frac{48}{40}$
-----------------	-----------------	-----------------	-----	-----------------	-----------------	-----------------

$\frac{45}{40}$	$\frac{46}{33}$	$\frac{46}{18}$	4.5	$\frac{48}{18}$	$\frac{49}{33}$	$\frac{49}{40}$
-----------------	-----------------	-----------------	-----	-----------------	-----------------	-----------------

$\frac{45}{40}$	$\frac{45}{33}$	$\frac{46}{18}$	4.4	$\frac{46}{18}$	$\frac{46}{33}$	$\frac{49}{40}$
-----------------	-----------------	-----------------	-----	-----------------	-----------------	-----------------

$\frac{46}{40}$	$\frac{47}{33}$	$\frac{47}{18}$	4.9	$\frac{49}{18}$	$\frac{49}{33}$	$\frac{51}{40}$	$\frac{52}{62}$
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$\frac{48}{40}$	$\frac{48}{33}$	$\frac{48}{18}$	4.9	$\frac{49}{18}$	$\frac{50}{33}$	$\frac{50}{40}$	$\frac{52}{62}$
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$\frac{11.9}{124.0}$	$\frac{26}{100}$	$\frac{71}{87}$	$\frac{65}{69}$	$\frac{62}{50}$	$\frac{60}{365}$	$\frac{56}{18}$	5.9	$\frac{5.9}{18}$	$\frac{6.1}{346}$	$\frac{6.3}{173.7}$	$\frac{5.9}{50}$	$\frac{5.7}{61.5}$	
$\frac{10.2}{1000}$	$\frac{9.5}{78.0}$	$\frac{9.4}{30.0}$	$\frac{8.3}{39}$	$\frac{7.8}{21}$	$\frac{8.0}{17}$	$\frac{8.1}{-0.9}$	$\frac{8.1}{18}$	$\frac{8.2}{31}$	$\frac{8.9}{-2.9}$	$\frac{8.8}{35}$	$\frac{8.4}{48}$	$\frac{7.1}{53}$	$\frac{6.3}{58}$

$\frac{11.5}{129.1}$	$\frac{11.6}{100.0}$	$\frac{10.0}{37}$	$\frac{9.8}{19}$	$\frac{9.9}{104.5}$	$\frac{9.7}{24}$	$\frac{9.0}{46}$	$\frac{9.7}{51}$	$\frac{6.8}{35}$
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$\frac{11.4}{100.4}$	$\frac{11.1}{50}$	$\frac{10.7}{40}$	$\frac{10.5}{5.59}$	$\frac{10.5}{18}$	$\frac{10.1}{-2.3}$	$\frac{10.0}{11}$	$\frac{5.96}{-3.0}$	$\frac{7.1}{4.3}$	$\frac{7.5}{49}$	$\frac{7.1}{52}$
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$\frac{11.6}{100}$	$\frac{11.0}{77}$	$\frac{11.1}{56}$	$\frac{10.5}{76}$	$\frac{10.3}{33}$	$\frac{10.4}{10}$	$\frac{10.0}{10}$	$\frac{9.4}{3.1}$	$\frac{8.9}{41}$	$\frac{7.6}{45}$	$\frac{7.5}{49}$
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Sta.	+	H.I.	-	Elev.
579		105.91		
4702				
4720				
T.M.	2.91	105.58	3.04	102.87
736	:			
751				
753				
761				
792				
5700				103.8
709				
721				
750				103.3
770				
782				

5.1 4.6 4.6 4.2 3.8 3.8 3.3 102.5 3.0 2.5 1.1 0.9
100 77 60 50 35 20 7 3.4 7 40 45 49

54 54 37 3.6 102.5 2.8 2.4 1.3 1.2
75 50 45 18 3.4 18 38 42 46

2.9 2.7 2.5 3.1 102.0 2.5 1.6 1.0
34 32 15 19 2.4 21 38 44

2.3 2.2 4.2 3.9 102.0 3.2 2.0 1.7 0.9
33 25 20 4 3.5 2 4 31 41

2.3 2.4 4.5 3.7 102.0 1.5 1.7 1.0 1.0
33 26 22 5 2.0 29 34 39 41

2.6 6.1 5.5 2.3 103.7 1.4 1.5 1.2
38 33 17 14 1.9 31 34 40

7.3 7.3 2.8 4.8 3.0 2.5 102.5 1.5 1.8 1.5 1.3
35 50 41 34 29 13 21 29 32 35 37

102
48
81 84
44 20

5.5 8.2 3.4 11.4 11.4 2.4 3.7 2.7 2.0 3/1.5 1.8 1.5 1.3
-6.2 34 32 31 26 31 17 10.8 101 31 34 36

13.2 13.1 10.9 5.6 2.9 102.3 1.5 1.7 1.1 1.3
50 38 28 25 14 21 25 29 34 36

14.1 12.8 4.9 2.6 102.6 1.2 1.6 1.2
50 51 19 19 1.8 14 30 35

14.6
60

9/14.7 14.8 14.1 12.7 7.8 2.2 1.7 1.3 3/1.4 1.5 1.8 1.0
-12.6 36 29 22 14 2 11.5 23 10.7 28 31 34

14.5 14.1 10.4 102.2 1.4 0.7
60 25 14 5.0 16 32

14.8 14.7 14.0 10.3 8.9 11.4 11.6 95.6 3.5 0.5 0.6
50 30 28 25 15 9 8 10.0 10 29 32

sta.	+	H.I	-	Flev.	
		105.58			
5+95					
6+00					
7+00					
T.P.	5.37	109.98	0.97	104.61	
B.M.			3.54	100.44	106.47

57

2

17

$\frac{145}{50}$	$\frac{145}{25}$	$\frac{91}{22}$	$\frac{89}{17}$	$\frac{134}{7}$	$\frac{93.3}{12.5}$	$\frac{110}{8}$	$\frac{14}{22}$	$\frac{0.4}{30}$	$\frac{0.5}{33}$
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$\frac{146}{50}$	$\frac{91}{22}$
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132

$\frac{145}{50}$	$\frac{144}{24}$	$\frac{150}{24}$	$\frac{148}{14}$	$\frac{91.3}{14.3}$	$\frac{7.1}{11}$	$\frac{2.0}{19}$	$\frac{0.5}{28}$	$\frac{0.6}{32}$
------------------	------------------	------------------	------------------	---------------------	------------------	------------------	------------------	------------------

Sta	+	H.I.	-	Elev.
B.M.	3.32	109.79		106.47
10+50				108.4
T.P.	4.02	99.66	12.15	97.64
10+50				108.4
10+60				
10+75				
10+90				109.3
T.P.	12.71	110.35	2.02	97.64
10+60				
10+75				
10+90				109.3
			3.25	107.10
				107.12

Vaido Red

$\frac{102}{-78}$	$\frac{9.7}{8}$	$\frac{42}{17}$	$\frac{2.2}{22}$	$\frac{5.2}{10}$	$\frac{2.1}{28.4}$
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$\frac{15.3}{80}$	$\frac{47.5}{-25.7}$	$\frac{140}{50}$	$\frac{122}{38}$	$\frac{20}{11}$
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$\frac{150}{75}$	$\frac{14.8}{72}$	$\frac{150}{50}$	$\frac{98}{34}$	$\frac{67}{10}$	39
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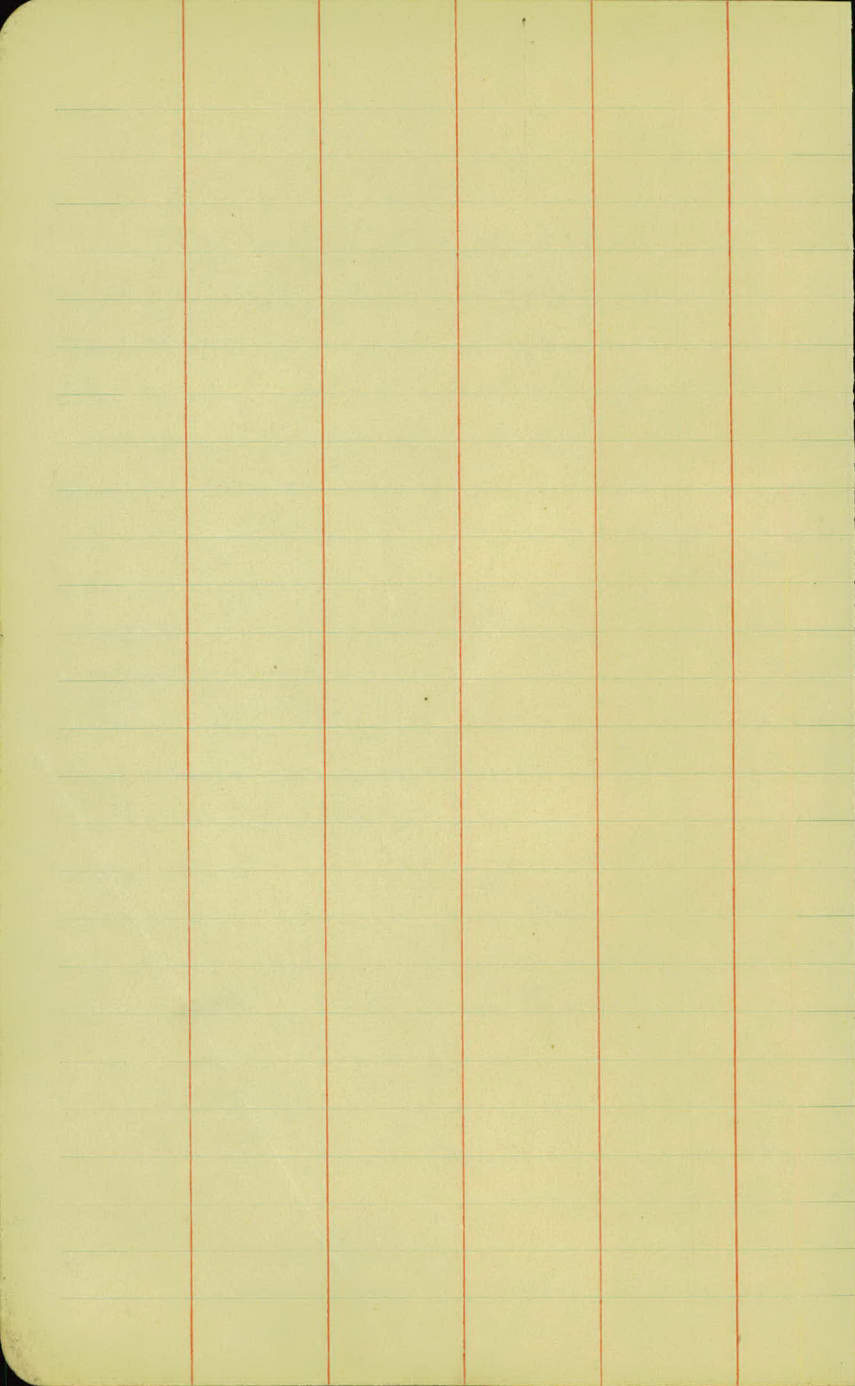
$\frac{12.7}{75}$	$\frac{11.9}{50}$	$\frac{109}{37}$	$\frac{77}{22}$	$\frac{47}{8}$
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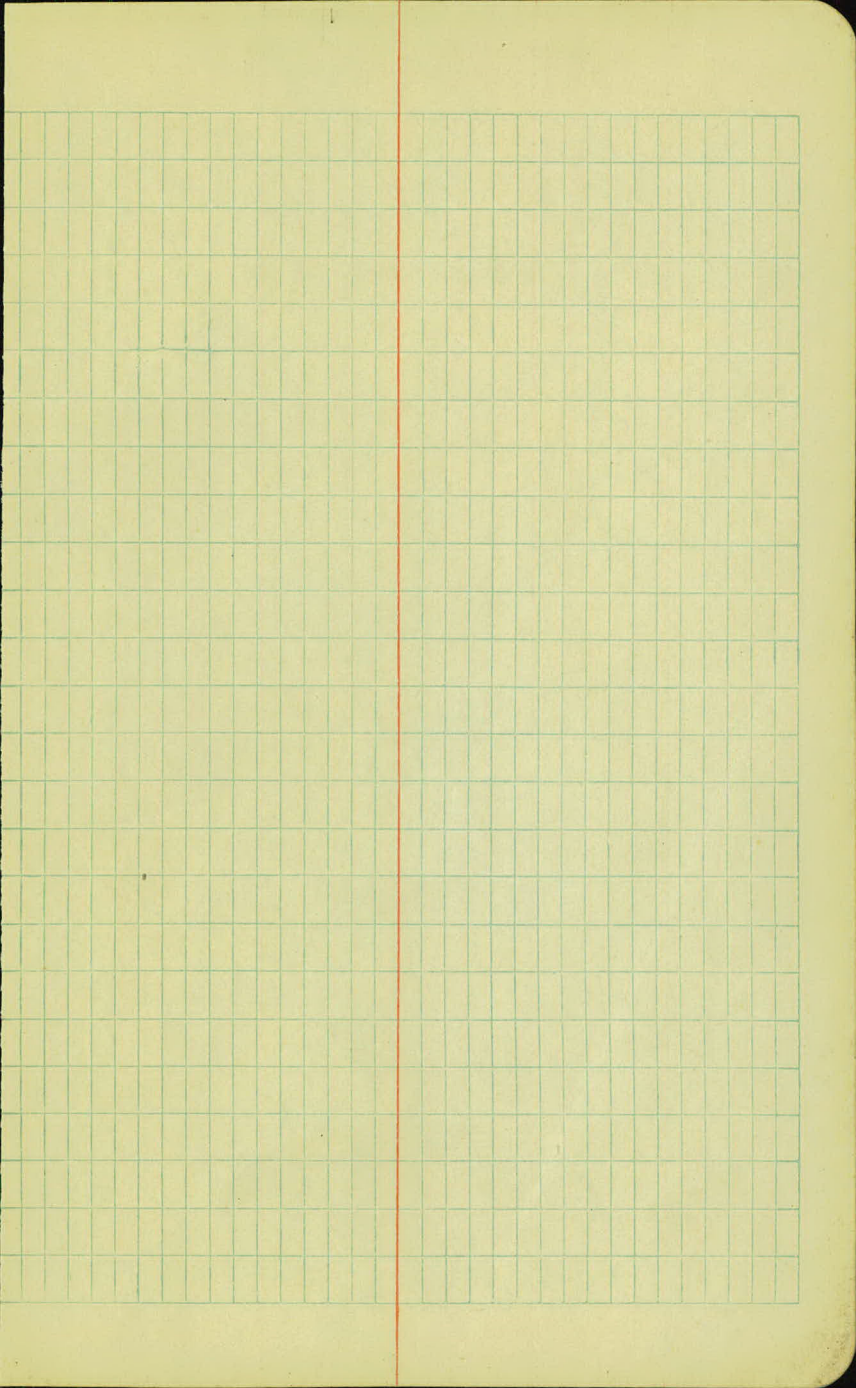
$\frac{3.5}{75}$	$\frac{3.7}{-135}$	$\frac{5.2}{50}$	$\frac{39}{37}$	$\frac{2.5}{31}$
------------------	--------------------	------------------	-----------------	------------------

$\frac{33}{18}$	$\frac{2.3}{23}$	$\frac{2.4}{27}$
-----------------	------------------	------------------

9.7	$\frac{6.1}{11}$	$\frac{2.1}{19}$	$\frac{2.1}{24}$
-----	------------------	------------------	------------------

4.3	$\frac{2.8}{7}$	$\frac{2.5}{14}$	$\frac{0.0}{-10}$	$\frac{1.7}{20.7}$
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Sta.	+	H. I.	-	Elev.
B.M.	4.03	110.50		106.47
9+75				102.4
10+00				100.6
10+15				99.7
10+34				98.5
10+50				99.0
10+60				93.9
10+80				95.5
11+00				105.9
T.P.			2.12	108.38
T.P.	3.08	100.37	13.21	97.29
T.P.	1.70	90.47	11.60	88.77
T.P.	0.95	78.51	12.91	77.54
9+75				102.4
T.P.	15.29	93.45	0.95	77.54

Copied from Carlson Notes
Aush + Branch

Spk. 111 P.P. Mt. Sta. 7752

$\frac{11.5}{7}$ 8.1 $\frac{70}{17}$ 4.2 $\frac{3.97}{32}$

T. Nail

9.9 $\frac{74}{5}$ 5.9 $\frac{57}{18}$ 4.0 $\frac{3.57}{32}$

T. Nail

12.8 $\frac{11.4}{6}$ 3.2 $\frac{4.0}{15}$ 2.4 $\frac{3.30}{32}$

T. Nail

12.0 $\frac{9.6}{13}$ 3.4 $\frac{3.4}{26}$ 2.8 $\frac{3.2}{32}$

T. Nail

11.5 $\frac{11.0}{12}$ 2.8 $\frac{2.8}{25}$ 2.45 $\frac{3.2}{32}$

T. Nail

16.6 $\frac{12.1}{12}$ 2.8 $\frac{2.8}{24}$ 2.17 $\frac{3.2}{32}$

T. Nail

15.0 $\frac{3.0}{21}$ 1.65 $\frac{1.65}{33}$

T. Nail

4.4 $\frac{2.5}{5}$ 2.0 $\frac{1.50}{29}$ 1.50 $\frac{3.4}{34}$

T. Nail

Top of Hup P.O.S.T.

Top of Stump.

Top of Rock.

$\frac{7.1}{100}$ $\frac{4.4}{82}$ $\frac{4.5}{55}$ $\frac{9.7}{48}$ $\frac{7.6}{40}$

+23.9

Sta.	+	H.I.	-	Elev
		93.45		
10+00				100.6
+15				97.7
T.P.	8.65	98.33	3.77	89.68
+34				98.5
+50				99.0
+60				93.7
+80				95.5
11+00				105.9
T.P.	11.04	107.93	1.44	96.89
T.P.	4.93	113.38	1.48	106.45
T.P.			5.02	108.36
T.P.	5.06	113.44		108.38
11+25				108.3
11+50				108.4
12+00				108.4

$\frac{7.0}{85}$	$\frac{5.4}{77}$	$\frac{3.5}{51}$	$\frac{10.8}{32}$	$\frac{10.9}{23}$	$\frac{8.3}{17}$	
						+2.1

$\frac{7.7}{90}$	$\frac{5.9}{69}$	$\frac{3.3}{50}$	$\frac{1.8}{35}$			+4.2
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$\frac{12.3}{85}$	$\frac{12.3}{78}$	$\frac{11.2}{64}$	$\frac{8.3}{50}$	$\frac{3.3}{29}$		+0.2
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$\frac{12.8}{85}$	$\frac{12.8}{70}$	$\frac{13.4}{65}$	$\frac{12.2}{50}$	$\frac{10.7}{38}$	$\frac{4.1}{18}$	+0.9
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$\frac{13.5}{85}$	$\frac{13.6}{73}$	$\frac{12.8}{50}$	$\frac{11.4}{33}$	$\frac{7.7}{19}$		4.4
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$\frac{13.3}{70}$	$\frac{12.4}{50}$	$\frac{9.8}{34}$	$\frac{7.0}{12}$			2.8
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$\frac{10.5}{67}$	$\frac{8.8}{55}$	$\frac{8.3}{46}$	$\frac{5.0}{29}$	$\frac{2.6}{20}$	$\frac{0.7}{18}$	+7.6
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Top of Hup P.O.S.T.

$\frac{7.7}{50}$	$\frac{6.6}{26}$			$\frac{4.2}{31}$	$\frac{3.9}{35}$	$\frac{5.00}{36}$	Top of Rail
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$\frac{7.7}{60}$	$\frac{7.0}{50}$	$\frac{6.3}{28}$		$\frac{3.6}{34}$	$\frac{3.0}{40}$	$\frac{2.85}{45}$	$\frac{3.1}{50}$	T. Rail
------------------	------------------	------------------	--	------------------	------------------	-------------------	------------------	---------

$\frac{11.1}{100}$	$\frac{9.0}{77}$	$\frac{6.7}{50}$	$\frac{6.1}{18}$		$\frac{5.9}{30}$	$\frac{3.2}{40}$	$\frac{2.7}{42}$	$\frac{2.25}{45}$	$\frac{2.17}{50}$	T. Rail
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579.	+	H.I.	-	Flev.
		113.44		
12750				109.5
+70				109.3
B.M.			0.21	113.23.

											Top of Rail		
<u>10.4</u>	<u>8.1</u>	<u>7.0</u>				<u>5.0</u>	<u>2.2</u>	<u>1.47</u>	<u>1.50</u>	<u>1.5</u>	<u>0.1</u>		
<u>94</u>	<u>50</u>	<u>33</u>	59			<u>16</u>	<u>44</u>	<u>48</u>	<u>53</u>	<u>77</u>	<u>96</u>		
										<u>2.3</u>	<u>1.3</u>		
										<u>75</u>	<u>91</u>		
<u>9.5</u>	<u>10.1</u>	<u>7.2</u>	<u>8.2</u>	<u>7.7</u>		<u>4.4</u>	<u>2.2</u>	<u>1.5</u>	<u>1.21</u>	<u>1.25</u>	<u>1.8</u>		
<u>90</u>	<u>81</u>	<u>78</u>	<u>50</u>	<u>40</u>	61	<u>17</u>	<u>42</u>	<u>47</u>	<u>50</u>	<u>55</u>	<u>66</u>		

Sy. N. in Tree Pt. St. 11462.

0119 L+ 009 R+

11+61 ⁴⁹	P.T.	12° 55'
+50		11° 50'
+25		9° -31'
11+00		7° -12'
PI	10+93 ⁴⁵	25° 50'
+75		4° 53'
+50		2° 34'
10+22 ³⁷	P.C.	0 -00'

$\Delta = 25^{\circ}50' \text{ Lt.}$

$18^{\circ}34' \text{ Curve Lt.}$

Rad = 309.95

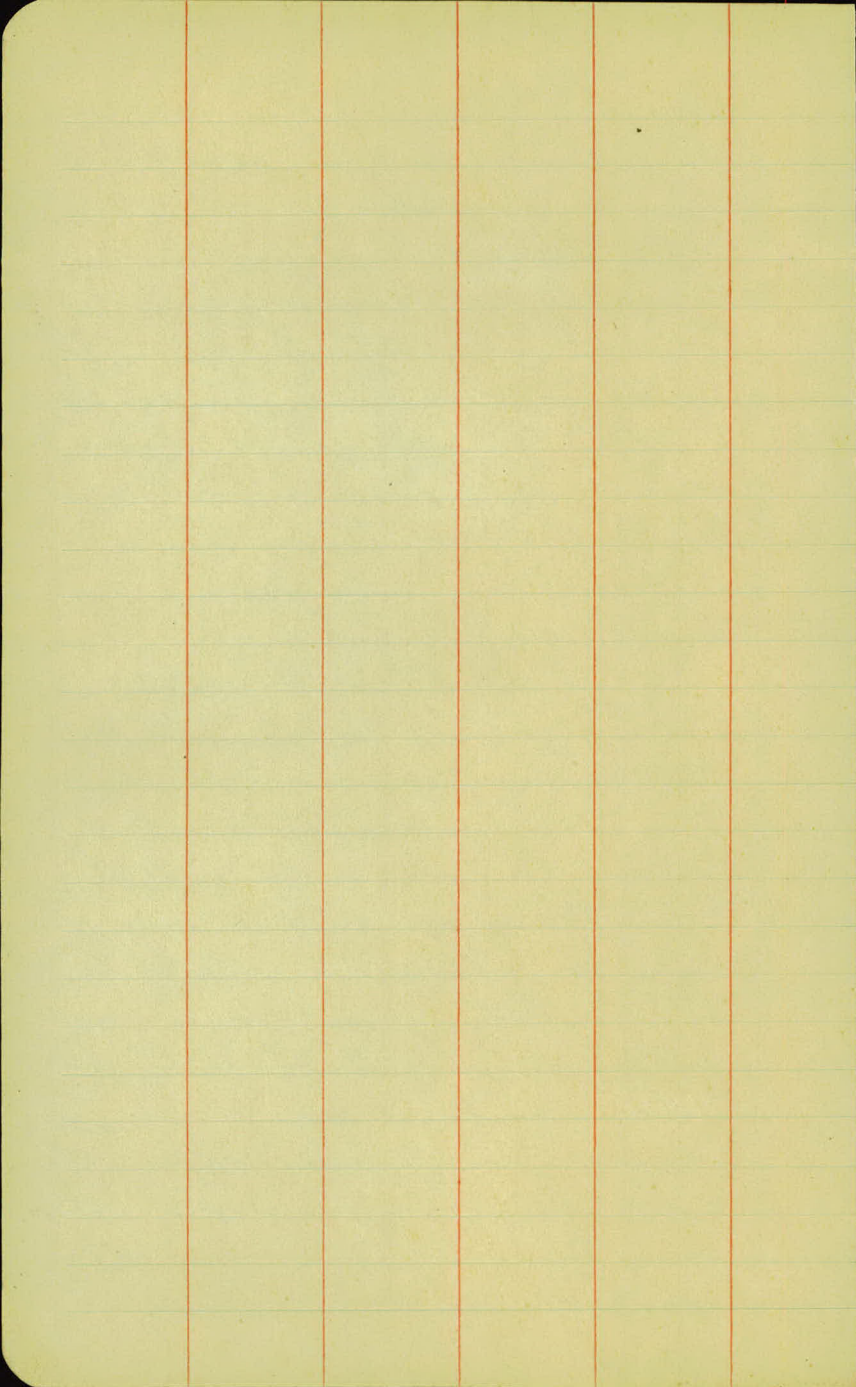
Tan = 71.08

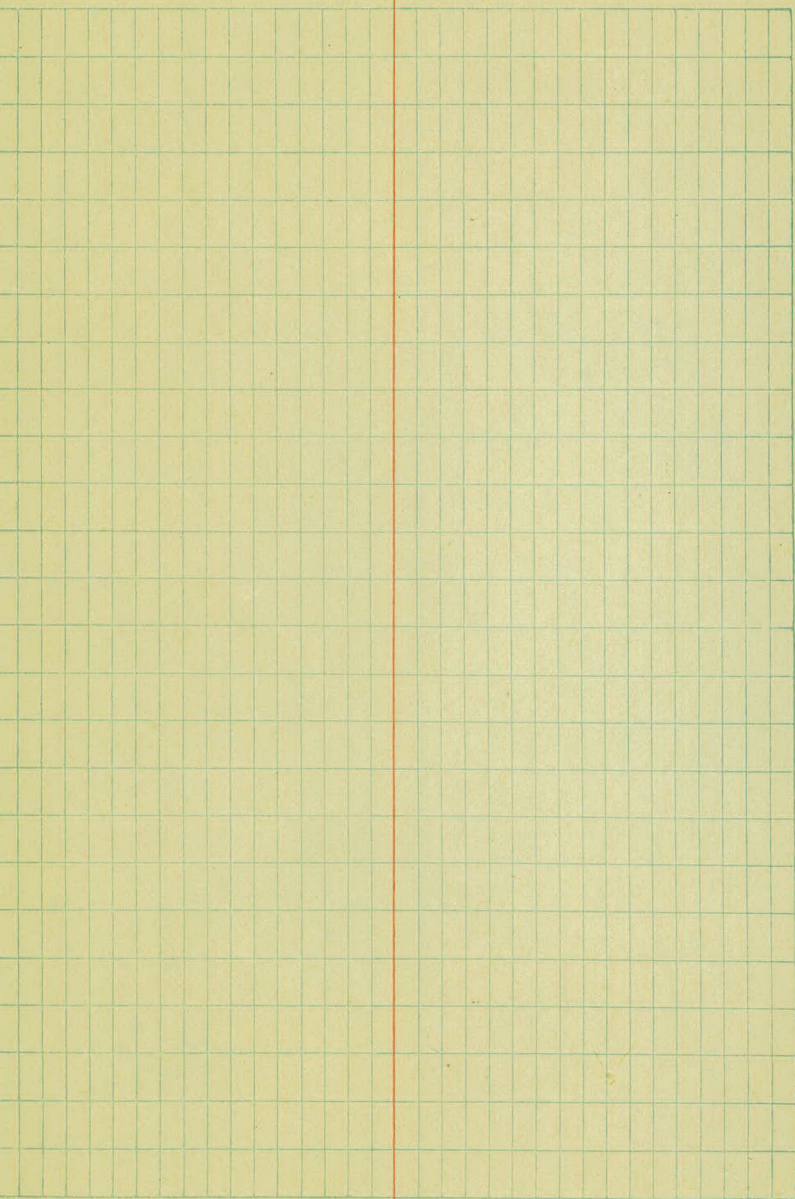
Leag. = 139.12

67.25 * P.P

Note This Curve
was run on the shoulder
line - Rt side

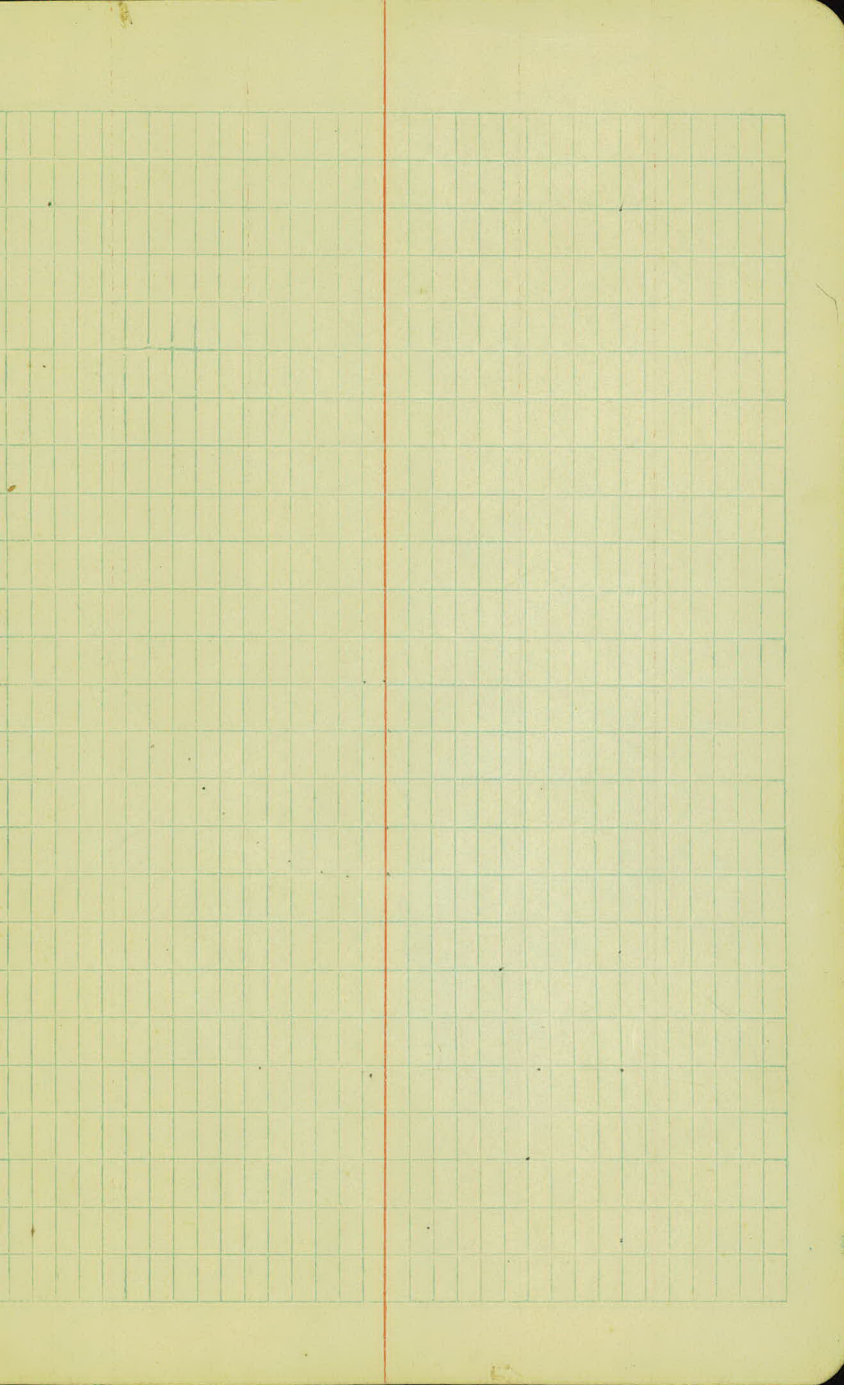
X 43.35
* P.P





112.72
931

103.41



Garage Road Alignment

Sta. Point Lt Rt.

3+50⁰³ P.O.T. End of line.

2+74⁹⁸ P.T.

1+75⁸⁴ P.I.

54°-50'

Δ - 54°-50'

D. - 25°-06'

T. - 119⁵²

L. - 218⁴⁰

R. - 230⁰³

0+50⁵² P.O.

0+50⁵² = 0'-0"
 1+75 - 2°-19"
 1+00 - 5°-27"
 1+25 - 8°-35"
 1+50 - 11°-43"
 1+75 - 14°-52"
 2+00 - 18°-00"
 1+25 - 21°-08"
 1+50 - 24°-16"
 1+74⁹¹ - 27°-25"
 27 Cor.

0+00 = 4+09 In Main line

8
26

Original - X-Sections Garage Road

Sta.	T	H.I.	-	Ref.	Elev.
P.M.	0.64	111.44		110.80	
0730 ⁵				9.7	101.7
0736 ⁵				9.4	102.0
0754 ⁵²				9.1	102.3
0775				9.7	101.7
T.P.	1.02	103.85	8.61	102.83	
1700				2.8	101.1
106 ⁵					98.9
1704				3.4	100.5
1719				12.2	91.7
T.P.	3.82	96.99	10.68	93.17	
1727				6.8	90.2
1734				5.9	91.1
1746				8.0	89.6
1767				8.7	88.3
1769				6.9	90.1

Top of Hyd. Lt. Sta. 3150

$\frac{99}{33} \frac{91}{74} \frac{96}{11} \quad 9.7$

$\frac{95}{33} \frac{95}{28} \frac{100}{25} \frac{99}{13} \quad 9.4 \quad 9.0$

$\frac{92}{33} \frac{90}{21} \frac{92}{12} \quad 9.1 \quad \frac{86}{8} \quad 8.8 \quad 8.5 \quad 8.1 \quad 10.1$
 $11 \quad 16 \quad 31 \quad 35$

$\frac{95}{33} \frac{100}{30} \frac{99}{11} \quad 8.8 \quad 9.7 \quad \frac{84}{9} \quad 8.5 \quad 11.6$
 $32 \quad 34$

$\frac{56}{33} \frac{50}{27} \frac{54}{18} \frac{6.8}{10} \frac{6.8}{9} \frac{4.7}{8} \quad 2.8 \quad \frac{2.3}{2.0} \quad 1.7 \quad \frac{5.8}{32} \quad \frac{5.8}{33}$
 $\frac{6.7}{33} \frac{5.8}{29} \frac{6.8}{18} \frac{8.1}{14} \frac{8.1}{12} \frac{5.0}{4} \quad 5.0 \quad \frac{5.0}{8} \quad 4.5 \quad 4.5 \quad 7.2 \quad 7.2$
 $\frac{7.1}{33} \frac{5.9}{29} \frac{6.5}{17} \frac{7.4}{19} \frac{7.4}{11} \frac{6.2}{9} \quad 3.4 \quad \frac{2.8}{16} \quad 4.2 \quad 4.2 \quad 6.7 \quad 6.7$
 $33 \quad 33 \quad 32 \quad 33$

$\frac{14.6}{33} \frac{12.6}{25} \frac{9.3}{16} \quad 12.2 \quad \frac{10.9}{12} \quad 6.8 \quad 8.0 \quad 9.0$
 $23 \quad 28 \quad 33$

$\frac{8.1}{33} \frac{2.3}{20} \frac{7.0}{9} \quad 6.8 \quad \frac{4.6}{12} \quad 2.0 \quad 1.9$
 33

$\frac{7.7}{33} \frac{3.6}{22} \frac{7.3}{16} \quad 7.5 \quad 5.9 \quad \frac{5.1}{13} \quad \frac{4.3}{14} \quad \frac{3.1}{20} \quad 2.5$
 33

$\frac{9.1}{33} \frac{8.1}{30} \frac{7.6}{30} \frac{7.5}{8} \quad 8.0 \quad \frac{6.8}{9} \quad 4.8 \quad 3.7 \quad 4.2$
 $12 \quad 29 \quad 33$

$\frac{11.0}{33} \frac{9.4}{10} \quad 8.7 \quad \frac{6.8}{1} \quad 3.9 \quad 5.6$
 $17 \quad 33$

$\frac{11.0}{33} \frac{7.9}{17} \quad 8.8 \quad 6.9 \quad \frac{6.0}{13} \quad 5.6$
 33

Sta.	T	H.I.	-	Rod.	Elev.
		96.99			
2+00				8.1	88.9
+25				9.0	88.0
+50				8.3	88.7
+75				8.5	88.5
B.M.	2.33	94.46	4.86	92.13	92.13
+89				5.6	88.9
3+00				4.6	89.9
+27				6.2	88.3
+50				6.6	87.9
+60				6.6	87.9
B.M.			4.11	88.35	

$\frac{11.7}{33}$ $\frac{9.7}{20}$ 8.1 $\frac{7.4}{14}$ $\frac{6.4}{33}$

$\frac{10.6}{33}$ $\frac{9.9}{28}$ $\frac{9.5}{17}$ 9.0 $\frac{8.3}{7}$ $\frac{7.0}{29}$ $\frac{7.0}{33}$

$\frac{11.2}{33}$ $\frac{8.7}{18}$ $\frac{9.3}{11}$ 8.3 $\frac{8.7}{7}$ $\frac{7.3}{19}$ $\frac{7.1}{29}$

$\frac{11.3}{33}$ $\frac{11.2}{31}$ $\frac{9.2}{25}$ 8.5 $\frac{7.1}{14}$ $\frac{6.7}{31}$

$\frac{8.4}{33}$ $\frac{7.7}{27}$ $\frac{6.7}{10}$ 5.6 $\frac{4.6}{11}$ $\frac{4.0}{31}$

$\frac{8.7}{33}$ $\frac{7.6}{26}$ $\frac{7.0}{15}$ 4.6 $\frac{3.9}{7}$ $\frac{4.8}{22}$ $\frac{5.2}{31}$

$\frac{7.7}{33}$ $\frac{6.7}{29}$ $\frac{6.9}{14}$ 6.2 $\frac{6.5}{19}$ $\frac{6.7}{31}$

$\frac{7.4}{33}$ $\frac{6.9}{19}$ 6.6 $\frac{6.7}{17}$ $\frac{7.0}{31}$

$\frac{7.4}{33}$ $\frac{6.9}{19}$ 6.6 $\frac{6.7}{17}$ $\frac{7.0}{31}$

Sph. in Tree H Sta. 3455.

Slope Stakes Garage Road

Sta.	+	H.I.	-	Elev.	Profile Grade
B.M.	0.37	111.17		110.80	
0+55					102.7
0+80	0.28	Super Elev. H. & M.			101.0
1+00	0.50	"	"	"	99.4
T.P.	0.67	103.50	8.34	102.83	
1+00					97.4
+25	0.5	Super Elev. H. & M.			97.4
T.P.	1.24	94.40	10.34	93.14	
+50	0.3	Super Elev. H. & M.			95.4
+75	0.5	"	"	"	95.4
1+00	0.5	"	"	"	91.4
+25	0.3	"	"	"	89.9
+50	0.0	"	"	"	89.4
+75					89.4
	4.93	93.60	5.75	88.67	
3+00					89.4

H.

E

M.

$$8.5 \quad \begin{array}{r} 85 \\ \times 58 \\ \hline 0.3 \end{array} \quad \begin{array}{r} 8.7 \\ -0.2 \end{array} \quad \begin{array}{r} 80 \\ \times 8.4 \\ \hline 10.1 \end{array} \quad \begin{array}{r} 80 \\ \times 8.6 \\ \hline 10.5 \end{array} \quad \text{D.C.}$$

$$0.2 \quad \begin{array}{r} 80 \\ \times 8.9 \\ \hline 1.0 \end{array} \quad \begin{array}{r} 9.7 \\ -10.5 \end{array} \quad \begin{array}{r} 80 \\ \times 8.4 \\ \hline 12.1 \end{array} \quad \begin{array}{r} 134 \\ \times 8.4 \\ \hline 12.7 \end{array} \quad \text{D.C.}$$

$$1.8 \quad \begin{array}{r} 102 \\ -114 \end{array} \quad \begin{array}{r} 80 \\ \times 9.9 \\ \hline 12.4 \end{array} \quad \begin{array}{r} 139 \\ \times 9.5 \\ \hline 134 \end{array} \quad \text{D.C.}$$

$$\begin{array}{r} 121 \\ \times 23 \\ \hline 2.7 \end{array}$$

$$6.1 \quad \begin{array}{r} 142 \\ \times 9.7 \\ \hline 4.1 \end{array} \quad \begin{array}{r} 128 \\ -0.7 \end{array} \quad \begin{array}{r} 10 \\ \times 10.0 \\ \hline 3.4 \end{array}$$

$$1.0 \quad \begin{array}{r} 182 \\ \times 5.3 \\ \hline 6.8 \end{array} \quad \begin{array}{r} 5.8 \\ -6.8 \end{array} \quad \begin{array}{r} 12 \\ \times 2.2 \\ \hline 2.7 \end{array}$$

$$1.0 \quad \begin{array}{r} 181 \\ \times 2.2 \\ \hline 6.7 \end{array} \quad \begin{array}{r} 4.4 \\ -3.4 \end{array} \quad \begin{array}{r} 11 \\ \times 3.9 \\ \hline 2.4 \end{array}$$

$$3.0 \quad \begin{array}{r} 14 \\ \times 5.5 \\ \hline 4.3 \end{array} \quad \begin{array}{r} 5.5 \\ -2.3 \end{array} \quad \begin{array}{r} 10 \\ \times 5.1 \\ \hline 2.6 \end{array}$$

$$4.5 \quad \begin{array}{r} 118 \\ \times 6.2 \\ \hline 2.5 \end{array} \quad \begin{array}{r} 6.4 \\ -1.4 \end{array} \quad \begin{array}{r} 9 \\ \times 3.7 \\ \hline 0.9 \end{array}$$

$$5.0 \quad \begin{array}{r} 4 \\ \times 6.7 \\ \hline 1.7 \end{array} \quad \begin{array}{r} 5.7 \\ -0.7 \end{array} \quad \begin{array}{r} 15 \\ \times 5.5 \\ \hline 0.5 \end{array}$$

$$5.0 \quad \begin{array}{r} 98 \\ \times 6.2 \\ \hline 1.2 \end{array} \quad \begin{array}{r} 5.9 \\ -0.9 \end{array} \quad \begin{array}{r} 15 \\ \times 4.5 \\ \hline 10.5 \end{array}$$

$$4.2 \quad \begin{array}{r} 115 \\ \times 5.0 \\ \hline 0.8 \end{array} \quad \begin{array}{r} 3.8 \\ -10.4 \end{array} \quad \begin{array}{r} 15 \\ \times 5.3 \\ \hline 10.9 \end{array}$$

93.60

3 725

894

3 750

894

B.M.

5.25

88.35

88.35

4.2

$$\begin{array}{r} 104 \overset{x}{/} 5.8 \\ \underline{75} \end{array}$$

$$\begin{array}{r} 5.4 \\ -1.2 \end{array}$$

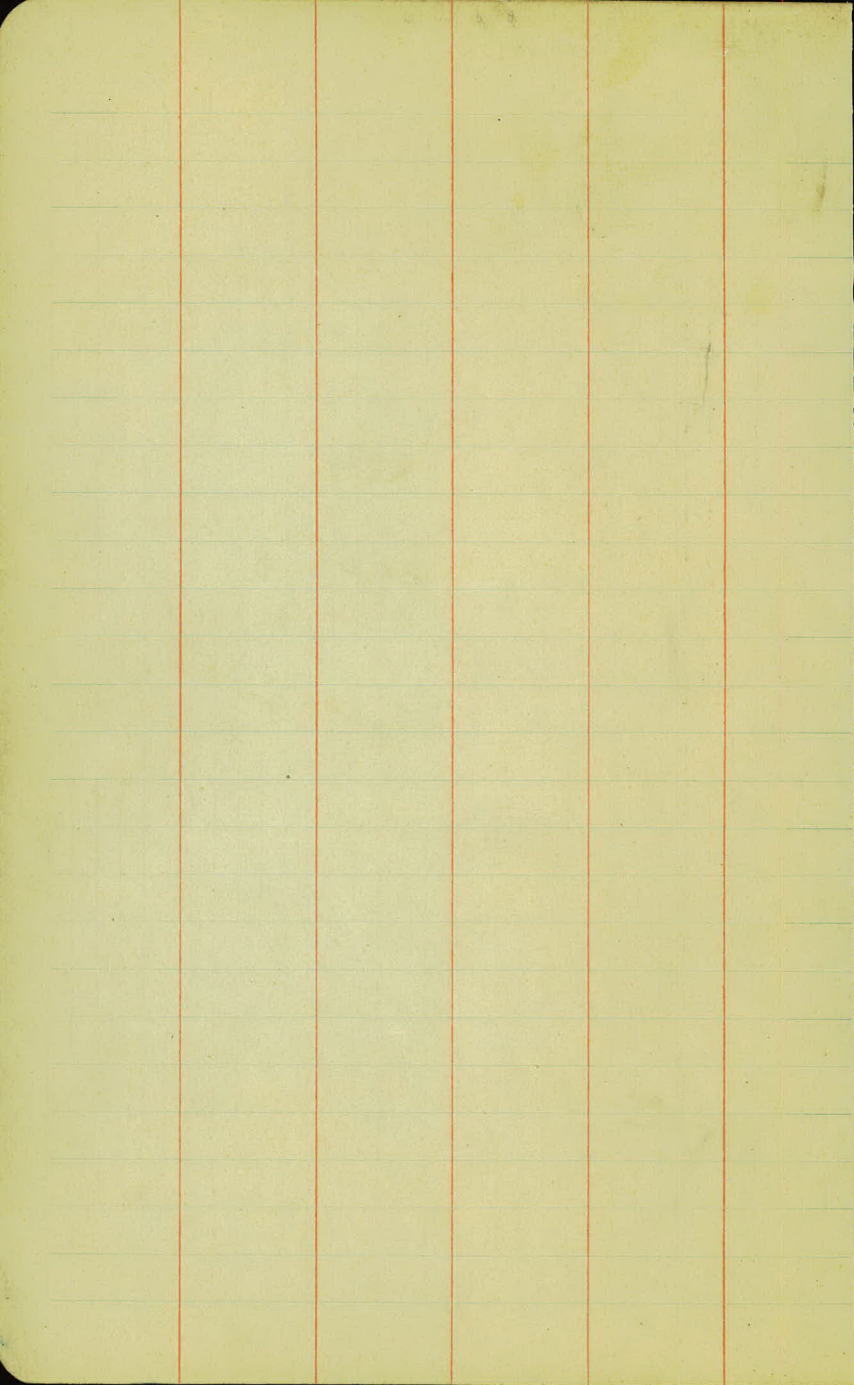
$$\begin{array}{r} 5 \overset{y}{/} 5.7 \\ \underline{75} \end{array}$$

4.2

$$\begin{array}{r} 104 \overset{x}{/} 5.9 \\ \underline{77} \end{array}$$

$$\begin{array}{r} 5.7 \\ -1.5 \end{array}$$

$$\begin{array}{r} 5 \overset{y}{/} 5.9 \\ \underline{77} \end{array}$$



85

90

95

100

105

103.95

102.7

104.0

99.4

95.4

91.4

89.9

89.4

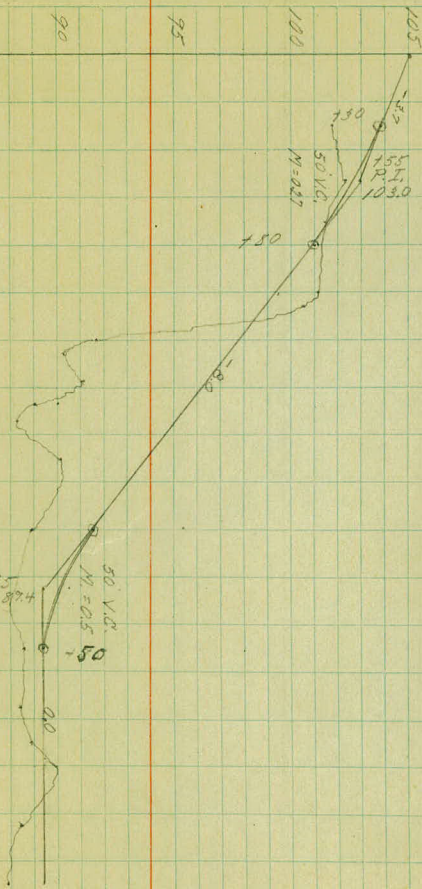
89.4

89.4

1700

2700

3700



Station + H.I. - Elev Gr. Rod

B.M. 7.91 109.38 106.47

10+50 108.50 0.90

+75

+90

Void. R.E.D.

11+00 10.30

T.P. 0.94 98.22 12.10 97.28

10+50 108.5 110.3

+75

+90

11+00 109.7 111.50

9-16-25

$$\begin{array}{r} 124 \\ -85 \\ \hline \end{array} \quad \begin{array}{r} 96 \\ -13 \\ \hline \end{array} \quad \begin{array}{r} 16 \\ -26 \\ \hline \end{array} \quad \begin{array}{r} 268x \\ 14 \\ -96 \\ \hline \end{array} \quad \begin{array}{r} 16 \\ -32 \\ \hline \end{array}$$

$$\begin{array}{r} 23 \\ -8 \\ \hline \end{array} \quad \begin{array}{r} 24 \\ -14 \\ \hline \end{array} \quad \begin{array}{r} 46 \\ -20 \\ \hline \end{array} \quad \begin{array}{r} 19 \\ -24 \\ \hline \end{array} \quad \begin{array}{r} 29 \\ -23 \\ \hline \end{array}$$

$$\begin{array}{r} 83 \\ -72 \\ \hline \end{array} \quad \begin{array}{r} 47 \\ -11 \\ \hline \end{array} \quad \begin{array}{r} 26 \\ -14 \\ \hline \end{array} \quad \begin{array}{r} 12 \\ -22 \\ \hline \end{array} \quad \begin{array}{r} 14 \\ -26 \\ \hline \end{array} \quad \begin{array}{r} 26 \\ -31 \\ \hline \end{array} \quad \begin{array}{r} 26 \\ -33 \\ \hline \end{array}$$

$$\begin{array}{r} 115 \\ -17 \\ \hline \end{array} \quad \begin{array}{r} 32 \\ -4 \\ \hline \end{array} \quad \begin{array}{r} 35 \\ -36 \\ \hline \end{array} \quad \begin{array}{r} 15 \\ -5 \\ \hline \end{array} \quad \begin{array}{r} 15 \\ -16 \\ \hline \end{array} \quad \begin{array}{r} 13 \\ -24 \\ \hline \end{array} \quad \begin{array}{r} 32x \\ 10.50 \\ -0.8 \\ \hline \end{array} \quad \begin{array}{r} 230 \\ -33 \\ \hline \end{array}$$

$$\begin{array}{r} 120 \\ -65 \\ \hline \end{array} \quad \begin{array}{r} 60x \\ 12.8 \\ -23.1 \\ \hline \end{array} \quad \begin{array}{r} 107 \\ -37 \\ \hline \end{array} \quad \begin{array}{r} 47 \\ -20 \\ \hline \end{array} \quad \begin{array}{r} 10 \\ -7 \\ \hline \end{array}$$

$$\begin{array}{r} 133 \\ -65 \\ \hline \end{array} \quad \begin{array}{r} 123 \\ -50 \\ \hline \end{array} \quad \begin{array}{r} 43 \\ -37 \\ \hline \end{array} \quad \begin{array}{r} 78 \\ -12 \\ \hline \end{array} \quad \begin{array}{r} 40 \\ -40 \\ \hline \end{array}$$

$$\begin{array}{r} 122 \\ -65 \\ \hline \end{array} \quad \begin{array}{r} 184 \\ -58 \\ \hline \end{array} \quad \begin{array}{r} 84 \\ -24 \\ \hline \end{array} \quad \begin{array}{r} 610 \\ -10 \\ \hline \end{array}$$

$$\begin{array}{r} 96 \\ -60 \\ \hline \end{array} \quad \begin{array}{r} 56x \\ 20.1 \\ \hline \end{array} \quad \begin{array}{r} 72 \\ -37 \\ \hline \end{array} \quad \begin{array}{r} 40 \\ -28 \\ \hline \end{array}$$

			C.R.	Elev	
B.M.	110.88	1.06		108.94	
+30.25			6.45	104.43	Edge Pav.
0+56.5			9.6	102.3	
+75			9.6	101.3	
1+00			11.0	99.9	
T.P.	96.1	99.25	11.74	99.14	
+25			1.2	98.6	
+50			3.9	96.0	
+75			5.9	93.9	
2+00			7.5	92.3	
+25			9.3	90.5	
250			10.5	89.3	
272.5			10.5	89.3	
B.M.			9.45	90.30	

spike in 36' tree SW of Sta 343

nail in cor of garage

Grad. Re

B.M.	1.68	110.62		108.94	
+52 ⁵				102.9	7.7
+75				101.7	8.8 8.7
1+00				99.9	10.6 10.7
T.P.	0.87	100.01	11.48	99.14	
+25				98.0	1.8 2.0 2.2
+50				96.1	3.7 3.9 4.1
+75				94.2	5.6 5.8 6.0
2+00				92.3	7.5 7.7 7.9
+25				90.4	9.4 9.6 9.8
B.M.			9.91	90.30	
+50				87.4	
+75				89.3	

spike in 36' tree 26' ht at 3+03 on the Pav.

$$\frac{7.7}{8}$$

$$\frac{7.7}{8}$$

$$\frac{7.7}{11}$$

$$\frac{8.8}{8}$$

$$\frac{8.8}{8}$$

$$\frac{8.8}{11}$$

$$\frac{10.6}{8}$$

$$\frac{10.7}{8}$$

$$\frac{10.7}{11}$$

$$\frac{11.8}{8}$$

$$\frac{12.2}{8}$$

$$\frac{12.2}{11}$$

$$\frac{13.7}{8}$$

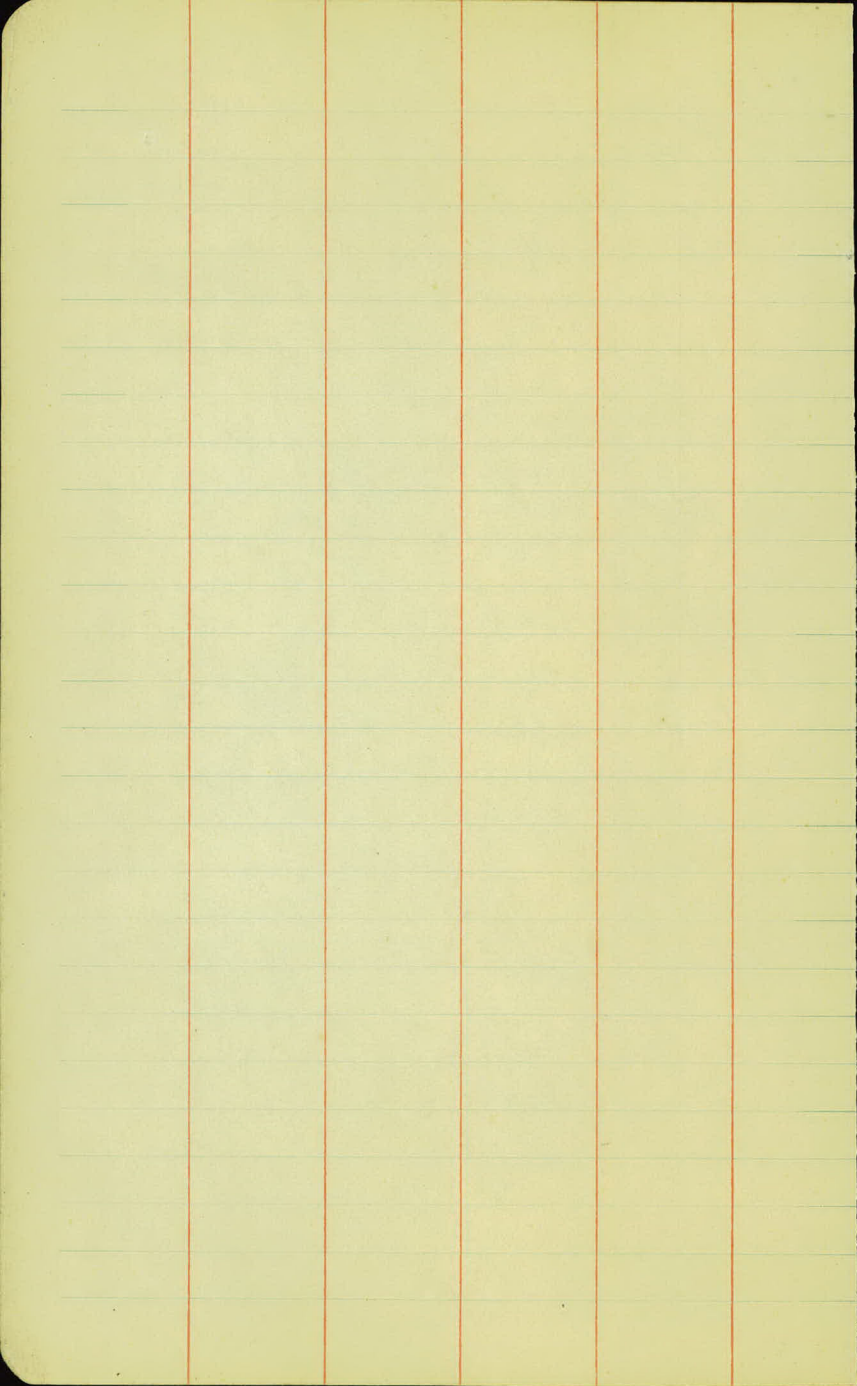
$$\frac{13.7}{8}$$

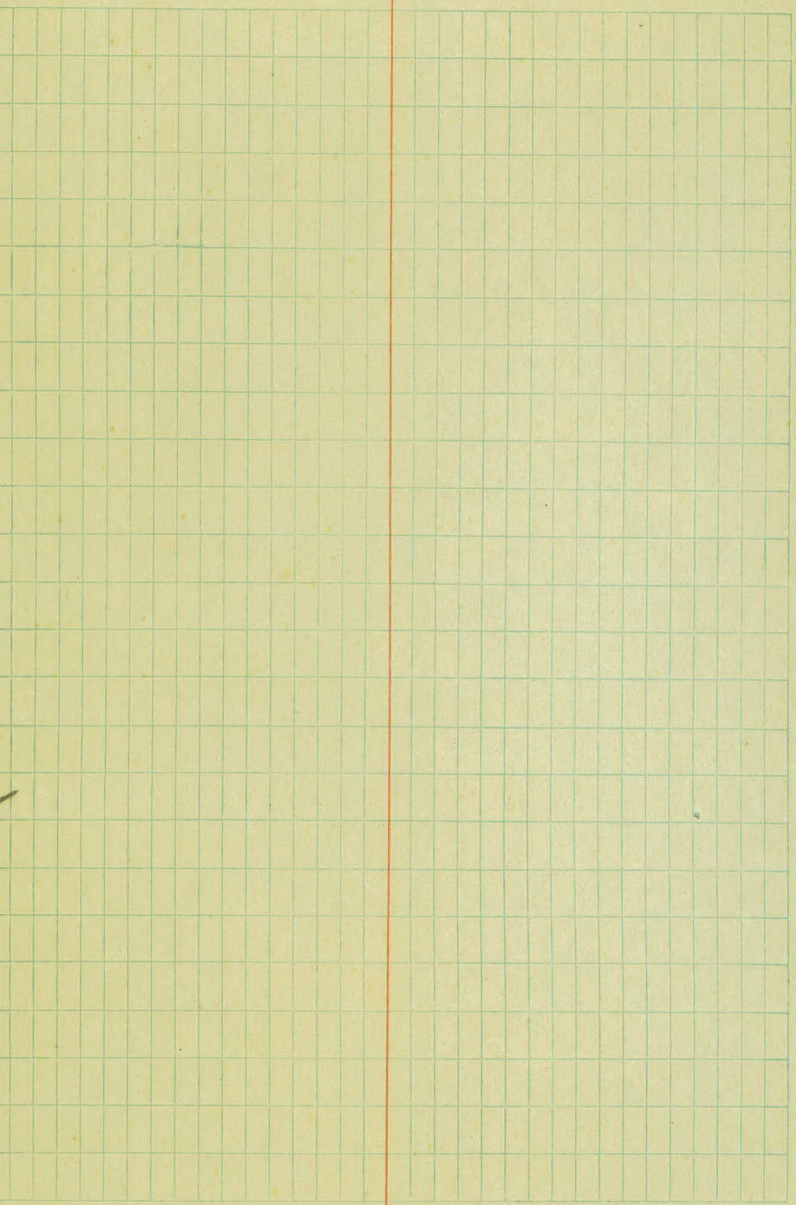
$$\frac{13.7}{11}$$

$$\frac{15.6}{8}$$

$$\frac{16.0}{8}$$

$$\frac{16.0}{11}$$





Proj. - 25-58 Grades.

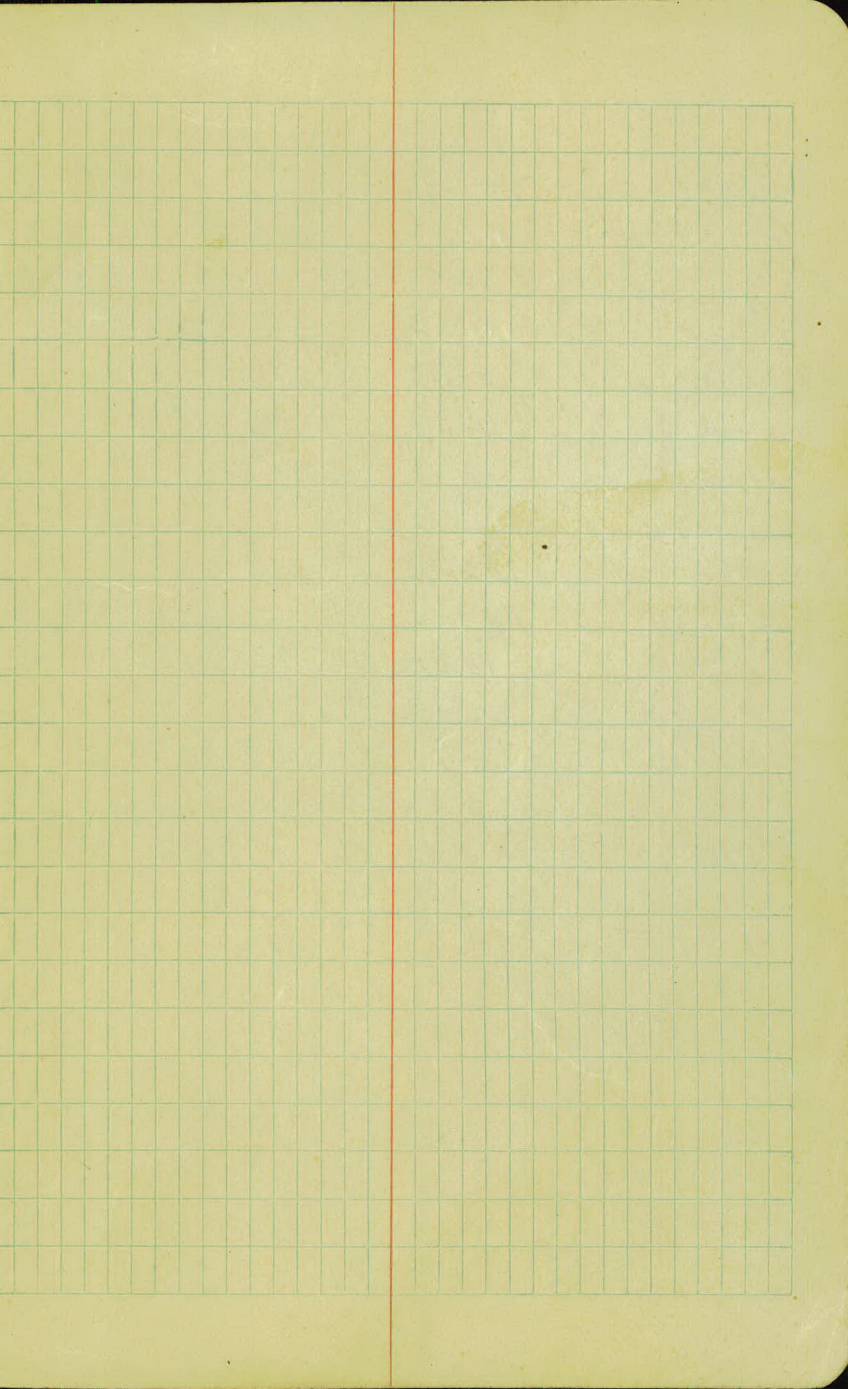
Station	Left		±	Right	
	Top. Curve End. Road	18' Top. Curve	Top. Pav.	18' Top. Curve	Top. Curve End. Road
0+00					
+25					
+50	108.99	109.25		109.25	
+75		109.03		109.03	
1+00		108.80		108.80	
+10				108.71	
+25		108.57		108.57	
+50		108.35		108.35	
+75		108.13		108.13	
2+00		107.90		107.90	
+25		107.68		107.68	
+50		107.45		107.45	
+70		107.26			
+72				107.23	
+85	107.86	107.57			
+87				107.57	107.83
3+00		106.91			
+01				106.90	107.83
+03	107.86	106.88			
+15		106.72			
+20				106.65	
+25		106.58		106.58	
+50		106.20		106.20	
+75		105.80		105.80	

10.26

23.5.31000 6.13

7.50
9.05

	End. Rod	Top of Corp
2+89	104.74	105.58
4+00		105.40
4+15		105.16
4+35	104.36	104.84
4+50		104.60
4+63		104.39
+75		104.20
5+00		103.80
+25		103.47
+50		103.30
+75		103.27
6+00		103.40
+25		103.60
+50		103.80
+75		104.00
7+57	PT	104.01
7+00		104.20
7+25		104.40
+50		104.60
+75		104.80
8+00		105.00
+25		105.20
+50		105.40
+75		105.60

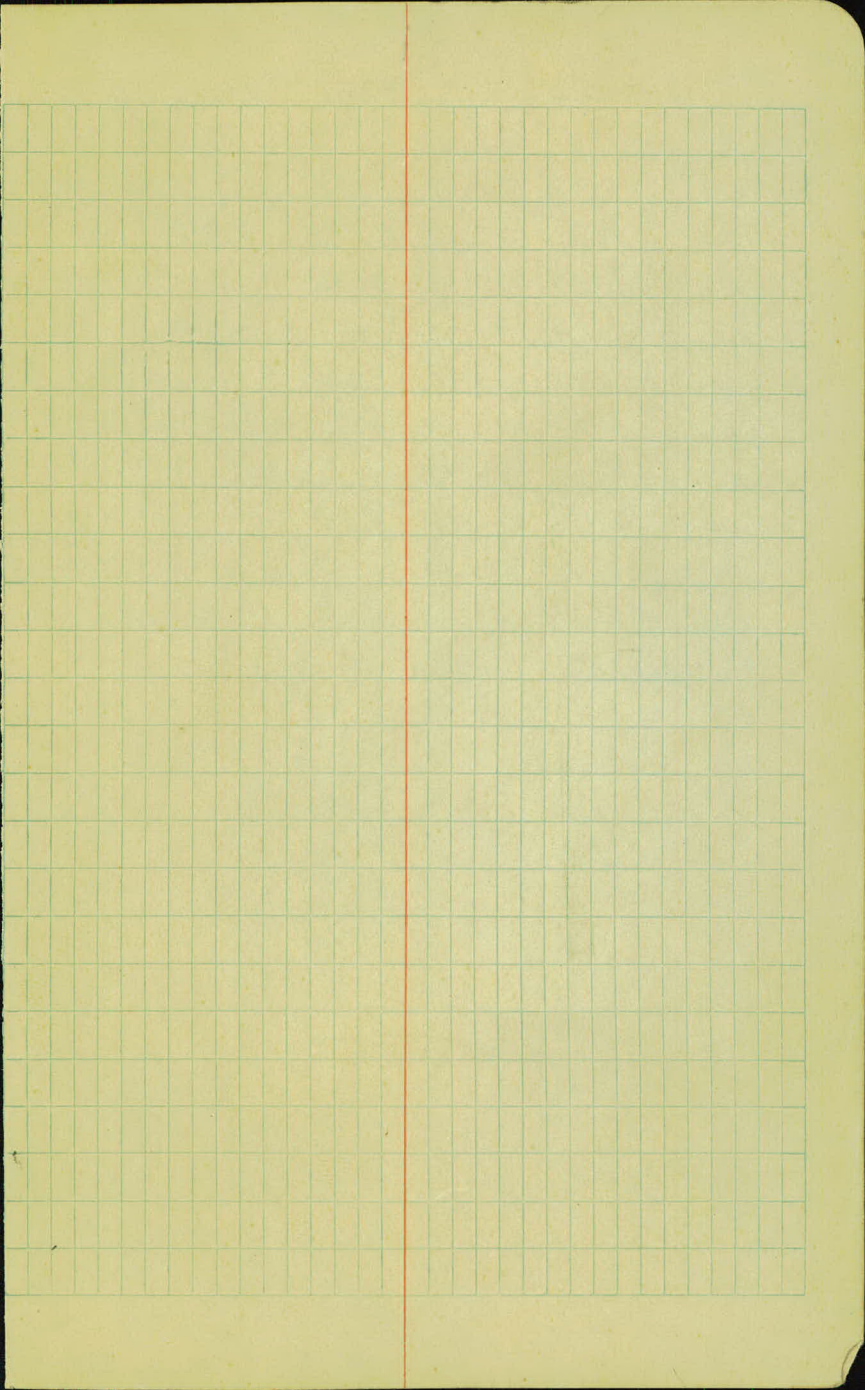


Changed. GUTTER
Grade RIGHT

Top
Curb.

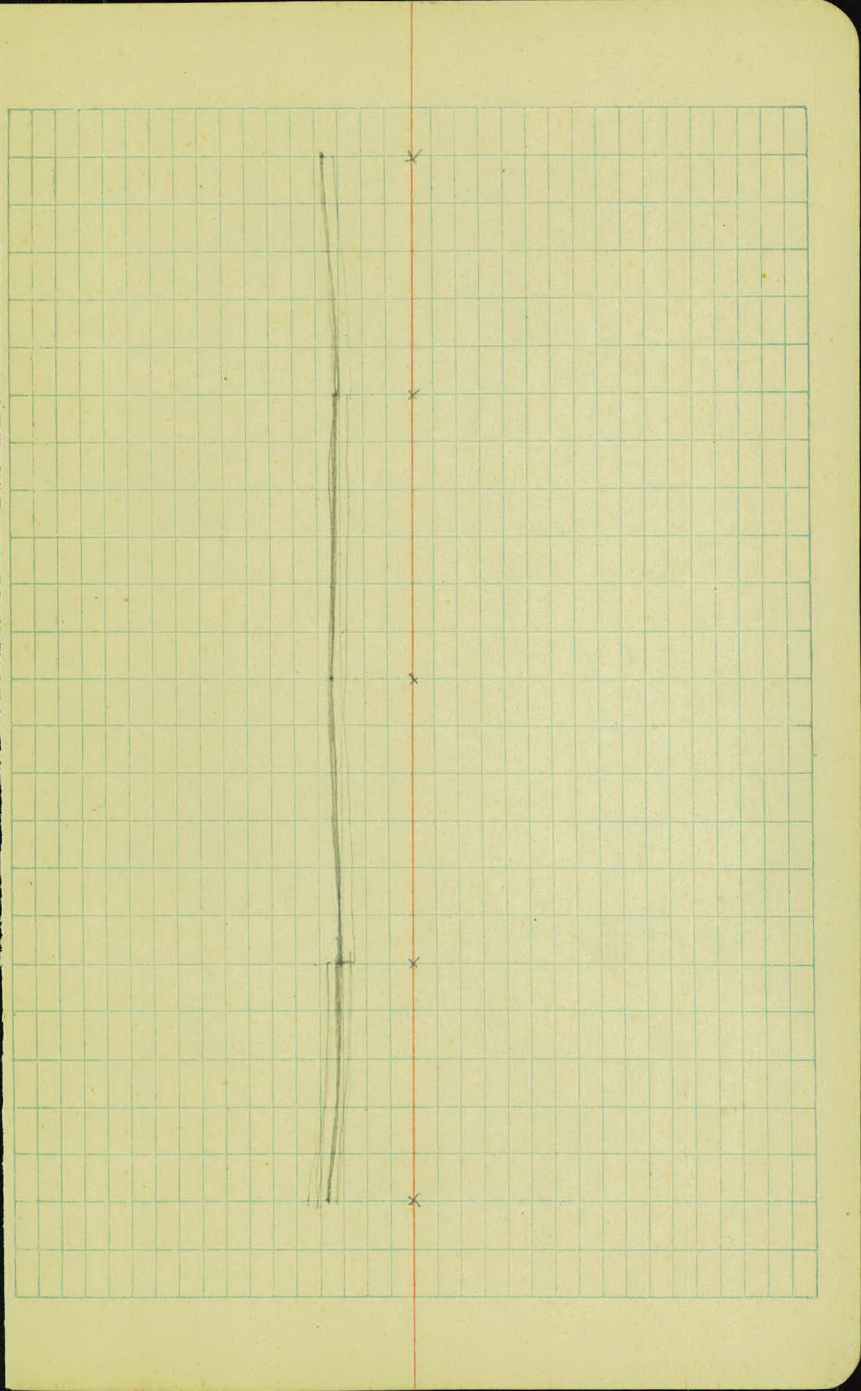
9+00	105.80	
+25	106.04 ✓	
+50	106.38	
+75	106.79 ?	
10+00	107.30	
+22.31	107.80 ✓	
+50	108.40 ✓	
+75	108.95 ✓	
11+00	109.50 ✓	
+25	110.05 ✓	
+50	110.60	110.36
+75	111.15 ✓	
12+00	111.70	110.80
13+50		111.00
12+60		111.61
12+90		111.17

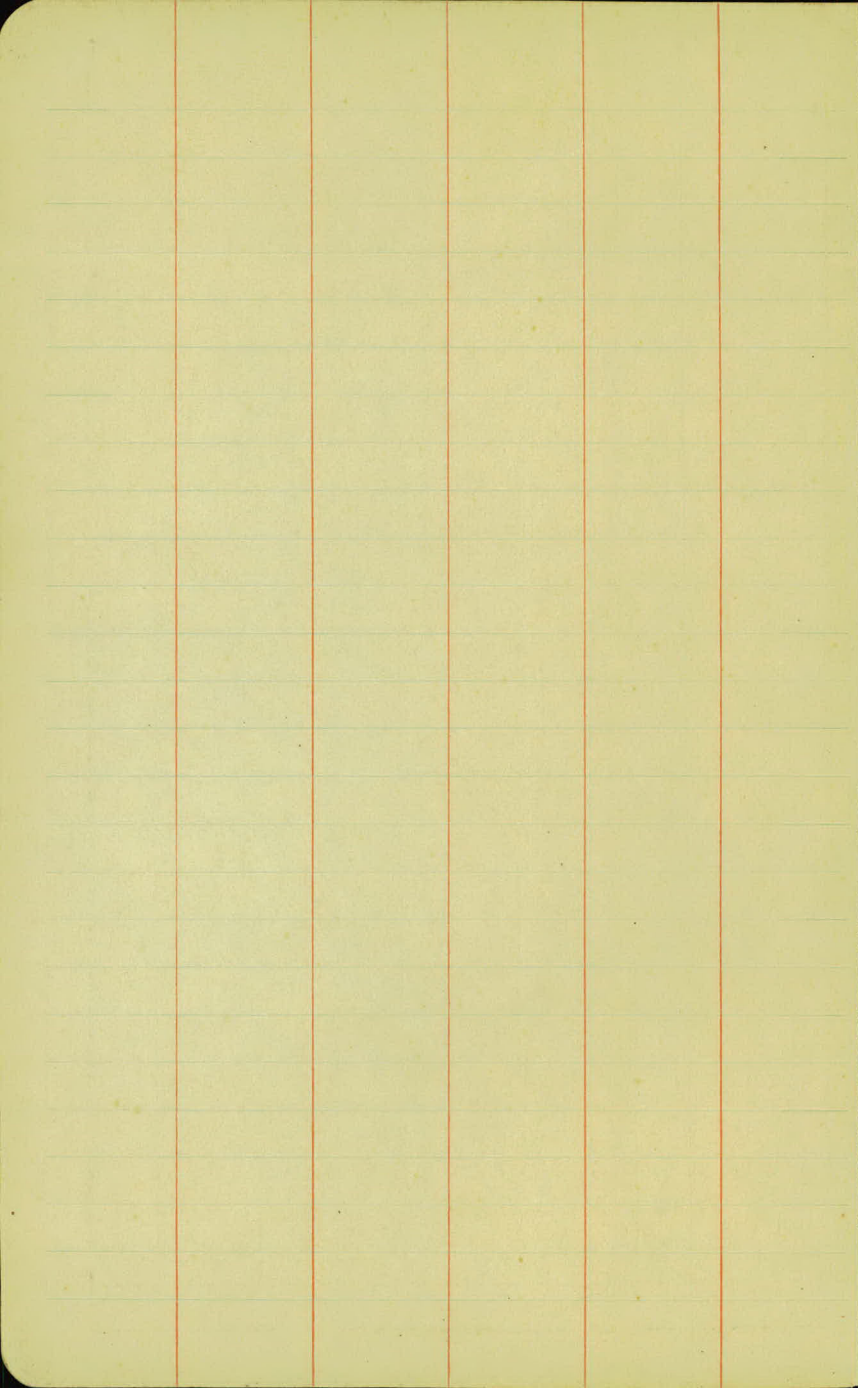
~~Void
Grade.
Change.~~



Grade Change

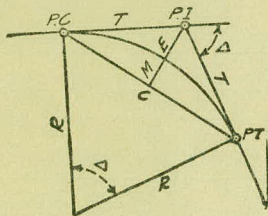
	♀	Rt. Citter	Top. Curb.	Lt. Gutter	Top. Curb.
10+00	107.18	106.63	107.30	106.63	107.30
+25	107.73	107.11	107.78	106.93	107.60
+50	108.28	107.59	108.26	107.24	107.91
+75	108.83	108.07	108.74	107.55	108.22
11+00	109.38	108.55	109.22	107.85	108.52
+25	109.88	109.03	109.70	108.12	108.82
+50	110.27	109.51	110.18	108.46	109.13
+75	110.59	109.99	110.66	108.77	109.44
12+00	110.73	110.47	111.14	109.07	109.74
+25	110.85	110.95	111.62	109.37	110.04
+50	110.98	111.43	112.10	109.68	110.35
+60	111.03	111.61	112.28	109.80	110.47
+90	111.17	112.54	113.21	110.16	110.83





DIETZGEN'S RAILROAD CURVE AND REDUCTION TABLES

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CURVE FORMULAS

Radius= $R = \frac{50}{\sin. \frac{D}{2}}$ (1) Degree of Curve= D and $\sin. \frac{D}{2} = \frac{50}{R}$ (2)

Tangent= $T = R \tan \frac{\Delta}{2}$ (3) Length of Curve= $L = 100 \frac{\Delta}{D}$ (4)

Middle ordinate= $M = R(1 - \cos. \frac{\Delta}{2})$ (5) $= R \text{vers} \frac{\Delta}{2}$ (6)

External= $E = T \tan \frac{\Delta}{4}$ (7) $= R \div \cos. \frac{\Delta}{2} - R$ (8) $= R \text{exsec} \frac{\Delta}{2}$ (9)

Long Chord= $C = 2 R \sin. \frac{\Delta}{2}$ (10) $\Delta =$ Central Angle

EXPLANATION AND USE OF TABLES

Stations.—Given P. I.=Sta. 161+60.35 to find Sta. of P. C. and P. T. $\Delta=62^{\circ} 10'$ $D=8^{\circ} 20'$. From Table IV for 1° curve $T=3454.1$ and $+8\frac{1}{3}=414.49$ ft. From Table V correction= $-.36$ or $T=414.85$ ft. P. C.=Sta. P. I.— $T=157+45.50$. Also from (4) $L=746.00$ and P. T.=Sta. P. C. + $L=164+91.50$.

Offsets.—Tangent offsets vary (approximately) directly with D and with square of the distance. Thus tangent offset for Sta. 158 on above curve is 2.16 ft. found as follows. From Table III tangent offset for 100 ft.=7.27 ft. Distance= 158 —Sta. P. C.= 54.50 , hence offset= $7.27 (54.50 \div 100)^2=2.16$ ft. Also square of any distance divided by twice the radius equals (approximately) the distance from tangent to curve. Thus $(54.50)^2 \div (2 \times 688.26)=2.16$ ft.

Deflections.—Deflection angle= $\frac{1}{2} D$ for 100 ft., $\frac{1}{4} D$ for 50 ft., etc. For c ft.=(in minutes) $.3 \times C \times D^{\circ}$ or=defl. for 1 ft. from Table III $\times C$. For Sta. 158 of above curve= $.3 \times 54.5 \times 8\frac{1}{3}=136.2'$ or $2^{\circ} 16.2'$, or= $2.50 \times 54.5=136.2'$ from Table III. For Sta. 159 deflection angle= $2^{\circ} 16.2' + 8^{\circ} 20' \div 2=6^{\circ} 26.2'$, etc.

Externals.—May be found in similar manner to tangents. Thus E for curve above is 91.37. For from Table IV for 1° curve $E=960.6$ for $8^{\circ} 20'=960.6 \div 8\frac{1}{3}=91.27$ and from Table V correction= $-.10$ or $E=91.37$ ft. Or suppose $\Delta=32^{\circ}$ and E is measured and found to be 42 ft. What is D ? From Table IV $E=230.9$ and $\div 42=5.5$ or $D=5^{\circ} 30'$.

TABLE I.—MINUTES IN DECIMALS OF A DEGREE.

1'	.0167	11'	.1833	21'	.3500	31'	.5167	41'	.6833	51'	.8500
2	.0333	12	.2000	22	.3667	32	.5333	42	.7000	52	.8667
3	.0500	13	.2167	23	.3833	33	.5500	43	.7167	53	.8833
4	.0667	14	.2333	24	.4000	34	.5667	44	.7333	54	.9000
5	.0833	15	.2500	25	.4167	35	.5833	45	.7500	55	.9167
6	.1000	16	.2667	26	.4333	36	.6000	46	.7667	56	.9333
7	.1167	17	.2833	27	.4500	37	.6167	47	.7833	57	.9500
8	.1333	18	.3000	28	.4667	38	.6333	48	.8000	58	.9667
9	.1500	19	.3167	29	.4833	39	.6500	49	.8167	59	.9833
10	.1667	20	.3333	30	.5000	40	.6667	50	.8333	60	1.0000

TABLE II.—INCHES IN DECIMALS OF A FOOT.

1-16	3-32	1/8	3-16	1/4	5-16	3/8	1/2	5/8	3/4	7/8
.0052	.0078	.0104	.0156	.0208	.0260	.0313	.0417	.0521	.0625	.0729
1	2	3	4	5	6	7	8	9	10	11
.0833	.1667	.2500	.3333	.4167	.5000	.5833	.6667	.7500	.8333	.9167

TABLE III.—RADI, ORDINATES AND DEFLECTIONS.

Deg.	Radius	Mid. Ord.	Tan. Offset	Def. for 1 Foot	Deg.	Radius	Mid. Ord.	Tan. Offset	Def. for 1 Foot
0° 10'	34377.5	.036	.145	0.05'	7°	819.02	1.528	6.105	2.10'
20	17188.8	.073	.291	0.10	20'	781.84	1.600	6.395	2.20
30	11459.2	.109	.436	0.15	30	764.49	1.637	6.540	2.25
40	8594.42	.145	.582	0.20	40	747.89	1.673	6.685	2.30
50	6875.55	.182	.727	0.25					
1	5729.65	.218	.873	0.30	8	716.78	1.746	6.976	2.40
10	4911.15	.255	1.018	0.35	20	688.16	1.819	7.266	2.50
20	4297.28	.291	1.164	0.40	30	674.69	1.855	7.411	2.55
30	3819.83	.327	1.309	0.45	40	661.74	1.892	7.556	2.60
40	3437.87	.364	1.454	0.50	9	637.28	1.965	7.846	2.70
50	3125.36	.400	1.600	0.55	20	614.58	2.037	8.136	2.80
					30	603.80	2.074	8.281	2.85
2	2864.93	.436	1.745	0.60	40	593.42	2.110	8.426	2.90
10	2644.58	.473	1.891	0.65					
20	2455.70	.509	2.036	0.70	10	573.69	2.183	8.716	3.00
30	2292.01	.545	2.181	0.75	30	546.44	2.292	9.150	3.15
40	2148.79	.582	2.327	0.80	11	521.67	2.402	9.585	3.30
50	2022.41	.618	2.472	0.85	30	499.06	2.511	10.02	3.45
					12	478.34	2.620	10.45	3.60
3	1910.08	.655	2.618	0.90	30	459.28	2.730	10.89	3.75
10	1809.57	.691	2.763	0.95	13	441.68	2.839	11.32	3.90
20	1719.12	.727	2.908	1.00	30	425.40	2.949	11.75	4.05
30	1637.28	.764	3.054	1.05	14	410.28	3.058	12.18	4.20
40	1562.88	.800	3.199	1.10	30	396.20	3.168	12.62	4.35
50	1494.95	.836	3.345	1.15					
					15	383.07	3.277	13.05	4.50
4	1432.69	.873	3.490	1.20	30	370.78	3.387	13.49	4.65
10	1375.40	.909	3.635	1.25	16	359.27	3.496	13.92	4.80
20	1322.53	.945	3.718	1.30	30	348.45	3.606	14.35	4.95
30	1273.57	.982	3.926	1.35	17	338.27	3.716	14.78	5.10
40	1228.11	1.018	4.071	1.40	18	319.62	3.935	15.64	5.40
50	1185.78	1.055	4.217	1.45	19	302.94	4.155	16.51	5.70
5	1146.28	1.091	4.362	1.50	20	287.94	4.374	17.37	6.00
10	1109.33	1.127	4.507	1.55	21	274.37	4.594	18.22	6.30
20	1074.68	1.164	4.653	1.60	22	262.04	4.814	19.08	6.60
30	1042.14	1.200	4.798	1.65	23	250.79	5.035	19.94	6.90
40	1011.51	1.237	4.943	1.70	24	240.49	5.255	20.79	7.20
50	982.64	1.273	5.088	1.75					
					25	231.01	5.476	21.64	7.50
6	955.37	1.309	5.234	1.80	26	222.27	5.697	22.50	7.80
10	929.57	1.346	5.379	1.85	27	214.18	5.918	23.35	8.10
20	905.13	1.382	5.524	1.90	28	206.68	6.139	24.19	8.40
30	881.95	1.418	5.669	1.95	29	199.70	6.360	25.04	8.70
40	859.92	1.455	5.814	2.00	30	193.18	6.583	25.88	9.00

Note. Chord Deflection=2 times tangent deflection.

TABLE IV.—TANGENTS AND EXTERNALS TO A 1° CURVE.

Central Angle	Tangent	External	Central Angle	Tangent	External	Central Angle	Tangent	External
1°	50.00	.22	11°	551.70	26.50	21°	1061.9	97.57
10'	58.34	.30	10'	560.11	27.31	10'	1070.6	99.16
20'	66.67	.39	20'	568.53	28.14	20'	1079.2	100.75
30'	75.01	.49	30'	576.95	28.97	30'	1087.8	102.35
40'	83.34	.61	40'	585.36	29.82	40'	1096.4	103.97
50'	91.68	.73	50'	593.79	30.68	50'	1105.1	105.60
2	100.01	.87	12	602.21	31.56	22	1113.7	107.24
10	108.35	1.02	10	610.64	32.45	10	1122.4	108.90
20	116.68	1.19	20	619.07	33.35	20	1131.0	110.57
30	125.02	1.36	30	627.50	34.26	30	1139.7	112.25
40	133.36	1.55	40	635.93	35.18	40	1148.4	113.95
50	141.70	1.75	50	644.37	36.12	50	1157.0	115.66
3	150.04	1.96	13	652.81	37.07	23	1165.7	117.38
10	158.38	2.19	10	661.25	38.03	10	1174.4	119.12
20	166.72	2.43	20	669.70	39.01	20	1183.1	120.87
30	175.06	2.67	30	678.15	39.99	30	1191.8	122.63
40	183.40	2.93	40	686.60	40.99	40	1200.5	124.41
50	191.74	3.21	50	695.06	42.00	50	1209.2	126.20
4	200.08	3.49	14	703.51	43.03	24	1217.9	128.00
10	208.43	3.79	10	711.97	44.07	10	1226.6	129.82
20	216.77	4.10	20	720.44	45.12	20	1235.3	131.65
30	225.12	4.42	30	728.90	46.18	30	1244.0	133.50
40	233.47	4.76	40	737.37	47.25	40	1252.8	135.35
50	241.81	5.10	50	745.85	48.34	50	1261.5	137.23
5	250.16	5.46	15	754.32	49.44	25	1270.2	139.11
10	258.51	5.83	10	762.80	50.55	10	1279.0	141.01
20	266.86	6.21	20	771.29	51.68	20	1287.7	142.93
30	275.21	6.61	30	779.77	52.89	30	1296.5	144.85
40	283.57	7.01	40	788.26	53.97	40	1305.3	146.79
50	291.92	7.43	50	796.75	55.13	50	1314.0	148.75
6	300.28	7.86	16	805.25	56.31	26	1322.8	150.71
10	308.64	8.31	10	813.75	57.50	10	1331.6	152.69
20	316.99	8.76	20	822.25	58.70	20	1340.4	154.69
30	325.35	9.23	30	830.76	59.91	30	1349.2	156.70
40	333.71	9.71	40	839.27	61.14	40	1358.0	158.72
50	342.08	10.20	50	847.78	62.38	50	1366.8	160.76
7	350.44	10.71	17	856.30	63.63	27	1375.6	162.81
10	358.81	11.22	10	864.82	64.90	10	1384.4	164.86
20	367.17	11.75	20	873.35	66.18	20	1393.2	166.95
30	375.54	12.29	30	881.88	67.47	30	1402.0	169.04
40	383.91	12.85	40	890.41	68.77	40	1410.9	171.15
50	392.28	13.41	50	898.95	70.09	50	1419.7	173.27
8	400.66	13.99	18	907.49	71.42	28	1428.6	175.41
10	409.03	14.58	10	916.03	72.76	10	1437.4	177.55
20	417.41	15.18	20	924.58	74.12	20	1446.3	179.72
30	425.79	15.80	30	933.13	75.49	30	1455.1	181.89
40	434.17	16.43	40	941.69	76.86	40	1464.0	184.08
50	442.55	17.07	50	950.25	78.26	50	1472.9	186.29
9	450.93	17.72	19	958.81	79.67	29	1481.8	188.51
10	459.32	18.38	10	967.38	81.09	10	1490.7	190.74
20	467.71	19.06	20	975.96	82.53	20	1499.6	192.99
30	476.10	19.75	30	984.53	83.97	30	1508.5	195.25
40	484.49	20.45	40	993.12	85.43	40	1517.4	197.53
50	492.88	21.16	50	1001.7	86.90	50	1526.3	199.82
10	501.28	21.89	20	1010.3	88.39	30	1535.3	202.12
10	509.68	22.62	10	1018.9	89.89	10	1544.2	204.44
20	518.08	23.38	20	1027.5	91.40	20	1553.1	206.77
30	526.48	24.14	30	1036.1	92.92	30	1562.1	209.12
40	534.89	24.91	40	1044.7	94.46	40	1571.0	211.48
50	543.29	25.70	50	1053.3	96.01	50	1580.0	213.86

TABLE IV.—TANGENTS AND EXTERNALS TO A 1° CURVE.

Central Angle	Tangent	External	Central Angle	Tangent	External	Central Angle	Tangent	External
31°	1589.0	216.3	41°	2142.2	387.4	51°	2732.9	618.4
10'	1598.0	218.7	10'	2151.7	390.7	10'	2743.1	622.8
20	1606.9	221.1	20	2161.2	394.1	20	2753.4	627.2
30	1615.9	223.5	30	2170.8	397.4	30	2763.7	631.7
40	1624.9	226.0	40	2180.3	400.8	40	2773.9	636.2
50	1633.9	228.4	50	2189.9	404.2	50	2784.2	640.7
32	1643.0	230.9	42	2199.4	407.6	52	2794.5	645.2
10	1652.0	233.4	10	2209.0	411.1	10	2804.9	649.7
20	1661.0	235.9	20	2218.6	414.5	20	2815.2	654.3
30	1670.0	238.4	30	2228.1	418.0	30	2825.6	658.8
40	1679.1	241.0	40	2237.7	421.4	40	2835.9	663.4
50	1688.1	243.5	50	2247.3	425.0	50	2846.3	668.0
33	1697.2	246.1	43	2257.0	428.5	53	2856.7	672.7
10	1706.3	248.7	10	2266.6	432.0	10	2867.1	677.3
20	1715.3	251.3	20	2276.2	435.6	20	2877.5	682.0
30	1724.4	253.9	30	2285.9	439.2	30	2888.0	686.7
40	1733.5	256.5	40	2295.6	442.8	40	2898.4	691.4
50	1742.6	259.1	50	2305.2	446.4	50	2908.9	696.1
34	1751.7	261.8	44	2314.9	450.0	54	2919.4	700.9
10	1760.8	264.5	10	2324.6	453.6	10	2929.9	705.7
20	1770.0	267.2	20	2334.3	457.3	20	2940.4	710.5
30	1779.1	269.9	30	2344.1	461.0	30	2951.0	715.3
40	1788.2	272.6	40	2353.8	464.6	40	2961.5	720.1
50	1797.4	275.3	50	2363.5	468.4	50	2972.1	725.0
35	1806.6	278.1	45	2373.3	472.1	55	2982.7	729.9
10	1815.7	280.8	10	2383.1	475.8	10	2993.3	734.8
20	1824.9	283.6	20	2392.8	479.6	20	3003.9	739.7
30	1834.1	286.4	30	2402.6	483.8	30	3014.5	744.6
40	1843.3	289.2	40	2412.4	487.2	40	3025.2	749.6
50	1852.5	292.0	50	2422.3	491.0	50	3035.8	754.6
36	1861.7	294.9	46	2432.1	494.8	56	3046.5	759.6
10	1870.9	297.7	10	2441.9	498.7	10	3057.2	764.6
20	1880.1	300.6	20	2451.8	502.5	20	3067.9	769.7
30	1889.4	303.5	30	2461.7	506.4	30	3078.7	774.7
40	1898.6	306.4	40	2471.5	510.3	40	3089.4	779.8
50	1907.9	309.3	50	2481.4	514.3	50	3100.2	784.9
37	1917.1	312.2	47	2491.3	518.2	57	3110.9	790.1
10	1926.4	315.2	10	2501.2	522.2	10	3121.7	795.2
20	1935.7	318.1	20	2511.2	526.1	20	3132.6	800.4
30	1945.0	321.1	30	2521.1	530.1	30	3143.4	805.6
40	1954.3	324.1	40	2531.1	534.2	40	3154.2	810.9
50	1963.6	327.1	50	2541.0	538.2	50	3165.1	816.1
38	1972.9	330.2	48	2551.0	542.2	58	3176.0	821.4
10	1982.2	333.2	10	2561.0	546.3	10	3186.9	826.7
20	1991.5	336.3	20	2571.0	550.4	20	3197.8	832.0
30	2000.9	339.3	30	2581.0	554.5	30	3208.8	837.3
40	2010.2	342.4	40	2591.0	558.6	40	3219.7	842.7
50	2019.6	345.5	50	2601.1	562.8	50	3230.7	848.1
39	2029.0	348.6	49	2611.2	566.9	59	3241.7	853.5
10	2038.4	351.8	10	2621.2	571.1	10	3252.7	858.9
20	2047.8	354.9	20	2631.3	575.3	20	3263.7	864.3
30	2057.2	358.1	30	2641.4	579.5	30	3274.8	869.8
40	2066.6	361.3	40	2651.5	583.8	40	3285.8	875.3
50	2076.0	364.5	50	2661.6	588.0	50	3296.9	880.8
40	2085.4	367.7	50	2671.8	592.3	60	3308.0	886.4
10	2094.9	371.0	10	2681.9	596.6	10	3319.1	892.0
20	2104.3	374.2	20	2692.1	600.9	20	3330.3	897.5
30	2113.8	377.5	30	2702.3	605.3	30	3341.4	903.2
40	2123.3	380.8	40	2712.5	609.6	40	3352.6	908.8
50	2132.7	384.1	50	2722.7	614.0	50	3363.8	914.5

TABLE IV.—TANGENTS AND EXTERNALS TO A 1° CURVE.

Central Angle	Tangent	External	Central Angle	Tangent	External	Central Angle	Tangent	External
61°	3375.0	920.2	71°	4086.9	1308.2	81°	4893.6	1805.3
10'	3386.3	925.9	10'	4099.5	1315.6	10'	4908.0	1814.7
20	3397.5	931.6	20	4112.1	1322.9	20	4922.5	1824.1
30	3408.8	937.3	30	4124.8	1330.3	30	4937.0	1833.6
40	3420.1	943.1	40	4137.4	1337.7	40	4951.5	1843.1
50	3431.4	948.9	50	4150.1	1345.1	50	4966.1	1852.6
62	3442.7	954.8	72	4162.8	1352.6	82	4980.7	1862.2
10	3454.1	960.6	10	4175.6	1360.1	10	4995.4	1871.8
20	3465.4	966.5	20	4188.5	1367.6	20	5010.0	1881.5
30	3476.8	972.4	30	4201.2	1375.2	30	5024.8	1891.2
40	3488.3	978.3	40	4214.0	1382.8	40	5039.5	1900.9
50	3499.7	984.3	50	4226.8	1390.4	50	5054.3	1910.7
63	3511.1	990.2	73	4239.7	1398.0	83	5069.2	1920.5
10	3522.6	996.2	10	4252.6	1405.7	10	5084.0	1930.4
20	3534.1	1002.3	20	4265.6	1413.5	20	5099.0	1940.3
30	3545.6	1008.3	30	4278.5	1421.2	30	5113.9	1950.3
40	3557.2	1014.4	40	4291.5	1429.0	40	5128.9	1960.2
50	3568.7	1020.5	50	4304.6	1436.8	50	5143.9	1970.3
64	3580.3	1026.6	74	4317.6	1444.6	84	5159.0	1980.4
10	3591.9	1032.8	10	4330.7	1452.5	10	5174.1	1990.5
20	3603.5	1039.0	20	4343.8	1460.4	20	5189.3	2000.6
30	3615.1	1045.2	30	4356.9	1468.4	30	5204.4	2010.8
40	3626.8	1051.4	40	4370.1	1476.4	40	5219.7	2021.1
50	3638.5	1057.7	50	4383.3	1484.4	50	5234.9	2031.4
65	3650.2	1063.9	75	4396.5	1492.4	85	5250.3	2041.7
10	3661.9	1070.2	10	4409.8	1500.5	10	5265.6	2052.1
20	3673.7	1076.6	20	4423.1	1508.6	20	5281.0	2062.5
30	3685.4	1082.9	30	4436.4	1516.7	30	5296.4	2073.0
40	3697.2	1089.3	40	4449.7	1524.9	40	5311.9	2083.5
50	3709.0	1095.7	50	4463.1	1533.1	50	5327.4	2094.1
66	3720.9	1102.2	76	4476.5	1541.4	86	5343.0	2104.7
10	3732.7	1108.6	10	4489.9	1549.7	10	5358.6	2115.3
20	3744.6	1115.1	20	4503.4	1558.0	20	5374.2	2126.0
30	3756.5	1121.7	30	4516.9	1566.3	30	5389.9	2136.7
40	3768.5	1128.2	40	4530.4	1574.7	40	5405.6	2147.5
50	3780.4	1134.8	50	4544.0	1583.1	50	5421.4	2158.4
67	3792.4	1141.4	77	4557.6	1591.6	87	5437.2	2169.2
10	3804.4	1148.0	10	4571.2	1600.1	10	5453.1	2180.2
20	3816.4	1154.7	20	4584.8	1608.6	20	5469.0	2191.1
30	3828.4	1161.3	30	4598.5	1617.1	30	5484.9	2202.2
40	3840.5	1168.1	40	4612.2	1625.7	40	5500.9	2213.2
50	3852.6	1174.8	50	4626.0	1634.4	50	5517.0	2224.3
68	3864.7	1181.6	78	4639.8	1643.0	88	5533.1	2235.5
10	3876.8	1188.4	10	4653.6	1651.7	10	5549.2	2246.7
20	3889.0	1195.2	20	4667.4	1660.5	20	5565.4	2258.0
30	3901.2	1202.0	30	4681.3	1669.2	30	5581.6	2269.3
40	3913.4	1208.9	40	4695.2	1678.1	40	5597.8	2280.6
50	3925.6	1215.8	50	4709.2	1686.9	50	5614.2	2292.0
69	3937.9	1222.7	79	4723.2	1695.8	89	5630.5	2303.5
10	3950.2	1229.7	10	4737.2	1704.7	10	5646.9	2315.0
20	3962.5	1236.7	20	4751.2	1713.7	20	5663.4	2326.6
30	3974.8	1243.7	30	4765.3	1722.7	30	5679.9	2338.2
40	3987.2	1250.8	40	4779.4	1731.7	40	5696.4	2349.8
50	3999.5	1257.9	50	4793.6	1740.8	50	5713.0	2361.5
70	4011.9	1265.0	80	4807.7	1749.9	90	5729.7	2373.3
10	4024.4	1272.1	10	4822.0	1759.0	10	5746.3	2385.1
20	4036.8	1279.3	20	4836.2	1768.2	20	5763.1	2397.0
30	4049.3	1286.5	30	4850.5	1777.4	30	5779.9	2408.9
40	4061.8	1293.6	40	4864.8	1786.7	40	5796.7	2420.9
50	4074.4	1300.9	50	4879.2	1796.0	50	5813.6	2432.9

TABLE IV.—TANGENTS AND EXTERNALS TO A 1° CURVE.

Central Angle	Tangent	External	Central Angle	Tangent	External	Central Angle	Tangent	External
91°	5830.5	2444.9	101°	6950.6	3278.1	111°	8336.7	4386.1
10'	5847.5	2457.1	10'	6971.3	3294.1	10'	8362.7	4407.6
20	5864.6	2469.3	20	6992.0	3310.1	20	8388.9	4429.2
30	5881.7	2481.5	30	7012.7	3326.1	30	8415.1	4450.9
40	5898.8	2493.8	40	7033.6	3342.3	40	8441.5	4472.7
50	5916.0	2506.1	50	7054.5	3358.5	50	8468.0	4494.6
92	5933.2	2518.5	102	7075.5	3374.9	112	8494.6	4516.6
10	5950.5	2531.0	10	7096.6	3391.2	10	8521.3	4538.8
20	5967.9	2543.5	20	7117.8	3407.7	20	8548.1	4561.1
30	5985.3	2556.0	30	7139.0	3424.3	30	8575.0	4583.4
40	6002.7	2568.6	40	7160.3	3440.9	40	8602.1	4606.0
50	6020.2	2581.3	50	7181.7	3457.6	50	8629.3	4628.6
93	6037.8	2594.0	103	7203.2	3474.4	113	8656.6	4651.3
10	6055.4	2606.8	10	7224.7	3491.3	10	8684.0	4674.2
20	6073.1	2619.7	20	7246.3	3508.2	20	8711.5	4697.2
30	6090.8	2632.6	30	7268.0	3525.2	30	8739.2	4720.3
40	6108.6	2645.5	40	7289.8	3542.4	40	8767.0	4743.6
50	6126.4	2658.5	50	7311.7	3559.6	50	8794.9	4766.9
94	6144.3	2671.6	104	7333.6	3576.8	114	8822.9	4790.4
10	6162.6	2684.7	10	7355.6	3594.2	10	8851.0	4814.1
20	6180.2	2697.9	20	7377.8	3611.7	20	8879.3	4837.8
30	6198.3	2711.2	30	7399.9	3629.2	30	8907.7	4861.7
40	6216.4	2724.5	40	7422.2	3646.8	40	8936.3	4885.7
50	6234.6	2737.9	50	7444.6	3664.5	50	8965.0	4909.9
95	6252.8	2751.3	105	7467.0	3682.3	115	8993.8	4934.1
10	6271.1	2764.8	10	7489.6	3700.2	10	9022.7	4958.6
20	6289.4	2778.3	20	7512.2	3718.2	20	9051.7	4983.1
30	6307.9	2792.0	30	7534.9	3736.2	30	9080.9	5007.8
40	6326.3	2805.6	40	7557.7	3754.4	40	9110.3	5032.6
50	6344.8	2819.4	50	7580.5	3772.6	50	9139.8	5057.6
96	6363.4	2833.2	106	7603.5	3791.0	116	9169.4	5082.7
10	6382.1	2847.0	10	7626.6	3809.4	10	9199.1	5107.9
20	6400.8	2861.0	20	7649.7	3827.9	20	9229.0	5133.3
30	6419.5	2875.0	30	7672.9	3846.5	30	9259.0	5158.8
40	6438.4	2889.0	40	7696.3	3865.2	40	9289.2	5184.5
50	6457.3	2903.1	50	7719.7	3884.0	50	9319.5	5210.3
97	6476.2	2917.3	107	7743.2	3902.9	117	9349.9	5236.2
10	6495.2	2931.6	10	7766.8	3921.9	10	9380.5	5262.3
20	6514.3	2945.9	20	7790.5	3940.9	20	9411.3	5288.6
30	6533.4	2960.3	30	7814.3	3960.1	30	9442.2	5315.0
40	6552.6	2974.7	40	7838.1	3979.4	40	9473.2	5341.5
50	6571.9	2989.2	50	7862.1	3998.7	50	9504.4	5368.2
98	6591.2	3003.8	108	7886.2	4018.2	118	9535.7	5395.1
10	6610.6	3018.4	10	7910.4	4037.8	10	9567.2	5422.1
20	6630.1	3033.1	20	7934.6	4057.4	20	9598.9	5449.2
30	6649.6	3047.9	30	7959.0	4077.2	30	9630.7	5476.5
40	6669.2	3062.8	40	7983.5	4097.1	40	9662.6	5504.0
50	6688.8	3077.7	50	8008.0	4117.0	50	9694.7	5531.7
99	6708.6	3092.7	109	8032.7	4137.1	119	9727.0	5559.4
10	6728.4	3107.7	10	8057.4	4157.3	10	9759.4	5587.4
20	6748.2	3122.9	20	8082.3	4177.5	20	9792.0	5615.6
30	6768.1	3138.1	30	8107.3	4197.9	30	9824.8	5643.8
40	6788.1	3153.3	40	8132.3	4218.4	40	9857.7	5672.3
50	5808.2	3168.7	50	8157.5	4239.0	50	9890.8	5700.9
100	6828.3	3184.1	110	8182.8	4259.7	120	9924.0	5729.7
10	6848.5	3199.6	10	8208.2	4280.5	10	9957.5	5758.6
20	6868.8	3215.1	20	8233.7	4301.4	20	9991.0	5787.7
30	6889.2	3230.8	30	8259.3	4322.4	30	10025.0	5817.0
40	6909.6	3246.5	40	8285.0	4343.6	40	10059.0	5846.5
50	6930.1	3262.3	50	8310.8	4364.8	50	10093.0	5876.1

TABLE V.—CORRECTIONS FOR TANGENTS AND EXTERNALS.

These corrections are to be added to the approximate values, found by dividing the tangent, or external, for a 1° curve (Table IV) by the degree of curve, in order to obtain the true tangents, or externals. Intermediate values may be obtained by interpolation.

FOR TANGENTS ADD

Central Angle	DEGREE OF CURVE													
	5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°
10°	.03	.06	.09	.13	.16	.19	.22	.25	.28	.31	.34	.38	.42	.46
15°	.04	.10	.14	.19	.24	.29	.34	.39	.45	.51	.53	.58	.63	.68
20°	.06	.13	.19	.26	.32	.39	.45	.51	.58	.65	.72	.79	.84	.90
25°	.08	.16	.24	.33	.40	.49	.58	.67	.75	.83	.90	.99	1.06	1.14
30°	.10	.19	.29	.39	.49	.59	.69	.79	.89	.99	1.09	1.20	1.29	1.39
35°	.11	.22	.34	.47	.58	.69	.79	.81	.92	1.04	1.29	1.42	1.54	1.66
40°	.13	.26	.40	.53	.67	.80	.93	1.06	1.20	1.34	1.49	1.64	1.79	1.94
45°	.15	.30	.44	.60	.76	.91	1.06	1.21	1.37	1.52	1.70	1.87	2.04	2.21
50°	.17	.34	.51	.68	.85	1.02	1.19	1.36	1.54	1.72	1.91	2.10	2.29	2.48
55°	.19	.38	.57	.76	.95	1.14	1.32	1.52	1.72	1.92	2.14	2.35	2.56	2.77
60°	.21	.42	.63	.84	1.05	1.27	1.49	1.71	1.94	2.17	2.38	2.60	2.83	3.07
65°	.23	.46	.69	.93	1.16	1.40	1.64	1.88	2.13	2.38	2.63	2.88	3.13	3.39
70°	.25	.51	.76	1.02	1.28	1.54	1.80	2.06	2.33	2.60	2.88	3.16	3.44	3.72
75°	.27	.56	.83	1.12	1.40	1.69	1.98	2.27	2.57	2.87	3.16	3.47	3.78	4.09
80°	.30	.61	.91	1.22	1.53	1.84	2.15	2.46	2.78	3.10	3.44	3.78	4.12	4.46
85°	.33	.66	1.00	1.33	1.68	2.02	2.36	2.70	3.05	3.40	3.77	4.14	4.55	4.89
90°	.36	.72	1.09	1.45	1.83	2.20	2.57	2.94	3.32	3.70	4.10	4.50	4.91	5.32
95°	.39	.79	1.19	1.55	2.00	2.40	2.80	3.20	3.61	4.02	4.40	4.98	5.38	5.83
100°	.43	.86	1.30	1.74	2.18	2.62	3.06	3.50	3.95	4.40	4.88	5.37	5.85	6.34
110°	.51	1.03	1.56	2.08	2.61	3.14	3.67	4.21	4.76	5.31	5.86	6.43	7.01	7.60
120°	.62	1.25	1.93	2.52	3.16	3.81	4.45	5.11	5.77	6.44	7.12	7.80	8.50	9.22

FOR EXTERNALS ADD

Central Angle.	DEGREE OF CURVE													
	5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°
10°	.001	.003	.004	.006	.007	.008	.009	.011	.012	.014	.015	.017	.018	.020
15°	.003	.007	.010	.014	.018	.023	.027	.029	.032	.035	.039	.043	.047	.051
20°	.006	.011	.017	.022	.028	.034	.038	.045	.051	.057	.063	.070	.076	.083
25°	.009	.018	.027	.036	.046	.056	.065	.074	.083	.093	.106	.120	.127	.135
30°	.013	.025	.038	.051	.065	.078	.090	.103	.116	.129	.149	.170	.179	.188
35°	.018	.035	.054	.072	.096	.109	.131	.153	.175	.197	.213	.230	.247	.264
40°	.023	.046	.070	.093	.117	.141	.172	.203	.234	.265	.277	.290	.315	.341
45°	.030	.060	.093	.119	.153	.184	.216	.254	.289	.325	.351	.378	.411	.455
50°	.037	.075	.116	.151	.189	.227	.266	.305	.345	.384	.425	.467	.508	.550
55°	.046	.093	.142	.188	.236	.283	.332	.381	.420	.479	.530	.582	.641	.700
60°	.056	.112	.168	.225	.283	.340	.398	.457	.516	.575	.636	.697	.774	.851
65°	.067	.135	.204	.273	.343	.412	.483	.554	.625	.697	.771	.845	.922	1.01
70°	.080	.159	.240	.321	.403	.485	.568	.652	.735	.819	.906	.994	1.08	1.17
75°	.095	.182	.266	.353	.440	.528	.618	.707	.797	.887	1.07	1.18	1.29	1.39
80°	.110	.220	.332	.445	.558	.671	.787	.903	1.02	1.13	1.25	1.38	1.50	1.62
85°	.128	.259	.391	.524	.657	.790	.926	1.06	1.20	1.34	1.47	1.62	1.76	1.91
90°	.149	.299	.450	.603	.756	.910	1.07	1.22	1.38	1.54	1.70	1.87	2.03	2.20
95°	.174	.350	.522	.706	.885	1.06	1.25	1.43	1.62	1.80	1.99	2.18	2.38	2.58
100°	.200	.401	.604	.809	1.01	1.22	1.43	1.64	1.85	2.06	2.28	2.50	2.73	2.96
110°	.268	.536	.806	1.08	1.35	1.63	1.91	2.20	2.48	2.76	3.05	3.35	3.66	3.96
120°	.360	.721	1.08	1.45	1.82	2.19	2.57	2.95	3.33	3.72	4.11	4.50	4.91	5.32

TABLE VI.—CORRECTIONS FOR SUB-CHORDS AND LONG CHORDS.

FOR SUB-CHORDS ADD										Excess of arc per 100 ft.	LONG CHORDS				
D	10	20	30	40	50	60	70	80	90		D	200	300	400	500
4°	.00	.00	.01	.01	.01	.01	.01	.01	.00	.02	1	199.99	299.97	399.92	499.85
6	.00	.61	.01	.02	.02	.02	.02	.01	.01	.05	2	199.97	299.88	399.70	499.39
8	.01	.02	.02	.03	.03	.03	.03	.02	.01	.08	3	199.93	299.73	399.32	498.63
10	.01	.02	.03	.04	.05	.05	.05	.04	.02	.13	4	199.88	299.51	398.78	497.57
12	.02	.04	.05	.06	.07	.07	.07	.05	.03	.18	5	199.81	299.24	398.10	496.20
14	.02	.05	.07	.08	.09	.10	.09	.07	.04	.25	6	199.73	298.90	397.26	494.53
16	.03	.06	.09	.11	.12	.12	.12	.09	.05	.33	7	199.63	298.51	396.28	492.57
18	.04	.08	.11	.14	.15	.16	.15	.12	.07	.41	8	199.51	298.05	395.14	490.31
20	.05	.10	.14	.17	.19	.20	.18	.15	.09	.51	9	199.38	297.54	393.86	487.75
22	.06	.12	.17	.21	.23	.24	.22	.18	.10	.62	10	199.24	296.96	392.42	484.90
24	.07	.14	.20	.25	.28	.28	.26	.21	.12	.74	12	198.90	295.63	389.12	478.34
26	.09	.17	.24	.29	.32	.33	.31	.25	.15	.86	14	198.51	294.06	385.22	470.65
28	.10	.19	.27	.34	.37	.38	.36	.29	.17	1.00	16	198.05	292.25	380.76	461.86
30	.11	.22	.31	.39	.43	.44	.41	.33	.19	1.15	18	197.54	290.21	375.74	452.02
32	.13	.25	.36	.44	.49	.50	.47	.38	.22	1.31	20	196.96	287.94	370.17	441.15
34	.15	.28	.40	.50	.55	.57	.53	.43	.25	1.48	22	196.32	285.44	364.06	429.30
36	.17	.32	.45	.56	.62	.64	.59	.48	.28	1.66	24	195.63	282.71	357.43	416.53
38	.18	.36	.51	.62	.70	.71	.66	.53	.31	1.86	26	194.87	279.76	350.30	402.89
40	.21	.40	.56	.69	.77	.79	.73	.59	.35	2.06	28	194.06	276.59	342.69	388.43
42	.23	.44	.62	.76	.85	.87	.81	.65	.38	2.28	30	193.18	273.20	334.61	373.20
44	.25	.48	.68	.84	.94	.96	.89	.72	.42	2.50	32	192.25	269.61	326.08	357.28
46	.27	.52	.75	.92	1.02	1.05	.98	.78	.46	2.74	34	191.26	265.81	317.12	340.73
48	.30	.57	.81	1.00	1.12	1.14	1.06	.86	.50	2.99	36	190.21	261.80	307.77	323.61
50	.32	.62	.89	1.09	1.21	1.24	1.15	.93	.55	3.24	38	189.10	257.60	298.03	305.99
52	.35	.67	.96	1.18	1.31	1.35	1.25	1.01	.59	3.52	40	187.94	253.21	287.94	287.94
54	.38	.73	1.04	1.28	1.42	1.46	1.35	1.09	.64	3.80	42	186.72	248.63	277.51	269.54
56	.41	.78	1.12	1.38	1.53	1.57	1.46	1.17	.69	4.09	44	185.44	243.87	266.78	250.85
58	.44	.84	1.20	1.48	1.65	1.69	1.57	1.26	.74	4.40	46	184.10	239.93	255.78	231.95
60	.47	.91	1.29	1.59	1.76	1.81	1.68	1.35	.80	4.72	48	182.71	233.83	244.51	212.92

NOTE.—When a chord of less than 100 ft. is used the corrections given in the above table should be added to the nominal length of chord to get the length which should be used in order that the 100 ft. points will check with those obtained by using the standard 100 ft. chord. Thus in locating a 14° curve by 25 ft. chords measure 25'.06 for each chord. Long chords are useful in passing obstacles.

TABLE VII.—MIDDLE ORDINATES FOR RAILS IN FEET.

Deg. of Curve	LENGTH OF RAILS							Deg. of Curve	LENGTH OF RAILS.						
	32	30	28	26	24	22	20		32	30	28	26	24	22	20
1°	.022	.020	.016	.013	.011	.009	.008	16°	.356	.313	.273	.236	.200	.170	.139
2	.045	.038	.034	.029	.025	.021	.017	17	.378	.333	.290	.252	.213	.180	.148
3	.037	.058	.051	.044	.037	.031	.026	18	.400	.351	.306	.265	.225	.190	.156
4	.089	.079	.069	.060	.050	.042	.035	19	.423	.371	.324	.280	.238	.201	.165
5	.112	.099	.086	.074	.063	.053	.044	20	.445	.392	.341	.296	.250	.212	.174
6	.134	.117	.102	.088	.076	.064	.052	21	.466	.410	.357	.309	.262	.222	.182
7	.156	.137	.120	.104	.088	.074	.061	22	.487	.430	.375	.325	.275	.233	.191
8	.179	.158	.137	.119	.100	.085	.070	23	.509	.450	.390	.338	.287	.243	.199
9	.201	.175	.153	.133	.112	.095	.078	24	.531	.469	.408	.354	.299	.253	.208
10	.223	.196	.171	.148	.125	.106	.087	25	.552	.486	.424	.367	.311	.263	.216
11	.245	.216	.188	.163	.139	.117	.096	25	.573	.506	.441	.382	.323	.274	.225
12	.268	.236	.206	.179	.151	.128	.105	27	.594	.524	.457	.390	.335	.284	.233
13	.290	.254	.222	.192	.163	.138	.113	28	.618	.545	.475	.411	.348	.294	.242
14	.312	.275	.239	.207	.175	.148	.122	29	.638	.564	.491	.424	.361	.303	.250
15	.334	.295	.257	.223	.188	.159	.131	30	.660	.583	.508	.438	.374	.313	.259

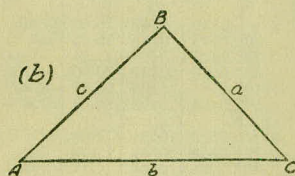
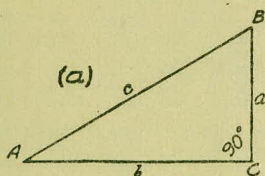
SLOPE REDUCTIONS.

When distances are measured on a slope they may be reduced to the equivalent horizontal distance by the following approximate rule:—subtract from the slope distance the square of the rise divided by twice the slope distance. Thus for a slope distance of 250.3 ft. and a rise of 15 ft. correction= $15^2 \div 2 \times 250.3 = .45$ (by slide rule) or horizontal distance= $250.3 - .45 = 249.85$. When vertical angle= $V. A.$ is measured horizontal distance= $\text{slope distance} - \text{slope distance} (1 - \text{Cos. } V. A.)$. Thus for slope distance of 248.7 ft. and $V. A.$ of $4^\circ 20'$ from Table VIII $\text{Cos.} = .99714$ and correction= $1 - .99714 = .00286$ per foot or total of $.286 \times 2\frac{1}{2}$ (near enough) = .57 and horizontal distance= $248.7 - .57 = 248.13$ ft.

See fig. (a).

TRIGONOMETRICAL FORMULAS.

$$\begin{aligned} \sin. & A = \frac{a}{c} \\ \cos. & A = \frac{b}{c} \\ \tan. & A = \frac{a}{b} \\ \cot. & A = \frac{b}{a} \\ \sec. & A = \frac{c}{b} \\ \text{cosec.} & A = \frac{c}{a} \end{aligned}$$



FORMULA FOR SOLVING TRIANGLES.

Given	Sought.	Right triangles. See fig. (a).
a, c	A, B, b	$\sin. A = \frac{a}{c}, \cos. B = \frac{a}{c}, b = \sqrt{(c+a)(c-a)}$
a, b	A, B, c	$\tan. A = \frac{a}{b}, \cot. B = \frac{a}{b}, c = \sqrt{a^2 + b^2}$
A, a	B, b, c	$B = 90^\circ - A, b = a \cot. A, c = \frac{a}{\sin. A}$
A, b	B, a, c	$B = 90^\circ - A, a = b \tan. A, c = \frac{b}{\cos. A}$
A, c	B, a, b	$B = 90^\circ - A, a = c \sin. A, b = c \cos. A$
Given	Sought.	Oblique triangles. See fig. (b).
A, B, a	b	$b = \frac{a \sin. B}{\sin. A}$
A, a, b	B	$\sin. B = \frac{b \sin. A}{a}$
a, b, C	$A - B$	$\tan. \frac{1}{2}(A - B) = \frac{(a - b) \tan. \frac{1}{2}(A + B)}{a + b}$
a, b, c	A	$\left\{ \begin{aligned} \text{If } s &= \frac{1}{2}(a + b + c), \sin. \frac{1}{2} A = \sqrt{\frac{(s - b)(s - c)}{bc}} \\ \cos. \frac{1}{2} A &= \sqrt{\frac{s(s - a)}{bc}}, \tan. \frac{1}{2} A = \sqrt{\frac{(s - b)(s - c)}{s(s - a)}} \\ \sin. A &= \frac{2\sqrt{s(s - a)(s - b)(s - c)}}{bc} \end{aligned} \right.$
A, B, C, a	area	$\text{area} = \frac{a^2 \sin. B \sin. C}{2 \sin. A}$
A, b, c	area	$\text{area} = \frac{1}{2} b c \sin. A$
a, b, c	area	$s = \frac{1}{2}(a + b + c), \text{area} = \sqrt{s(s - a)(s - b)(s - c)}$

TABLE VIII.—NATURAL TRIGONOMETRICAL FUNCTIONS.

Angle	Sine.	Tan.	Cotg.	Cosin.		Angle	Sine.	Tan.	Cotg.	Cosin.	
0	0	0	∞	1	90	8	.1392	.1405	7.115	.99027	
10	.0029	.0029	343.8	I	50	10	.1421	.1435	6.968	.98986	
20	.0058	.0058	171.9	.99998	40	20	.1449	.1465	6.827	.98944	
30	.0087	.0087	114.6	.99996	30	30	.1478	.1495	6.691	.98902	
40	.0116	.0116	85.94	.99993	20	40	.1507	.1524	6.561	.98858	
50	.0145	.0145	68.75	.99989	10	50	.1536	.1554	6.435	.98814	
1	.0175	.0175	57.29	.99985	89	9	.1564	.1584	6.314	.98769	
10	.0204	.0204	49.10	.99979	50	10	.1593	.1614	6.197	.98723	
20	.0233	.0233	42.96	.99973	40	20	.1622	.1644	6.084	.98676	
30	.0262	.0262	38.19	.99966	30	30	.1650	.1673	5.976	.98629	
40	.0291	.0291	34.37	.99958	20	40	.1679	.1703	5.871	.98580	
50	.0320	.0320	31.24	.99949	10	50	.1708	.1738	5.769	.98531	
2	.0349	.0349	28.64	.99939	88	10	.1736	.1763	5.671	.98481	
10	.0378	.0378	26.43	.99929	50	10	.1765	.1793	5.576	.98430	
20	.0407	.0407	24.54	.99917	40	20	.1794	.1823	5.485	.98378	
30	.0436	.0437	22.90	.99905	30	30	.1822	.1853	5.396	.98325	
40	.0465	.0466	21.47	.99892	20	40	.1851	.1883	5.309	.98272	
50	.0494	.0495	20.21	.99878	10	50	.1880	.1914	5.226	.98218	
3	.0523	.0524	19.08	.99863	87	11	.1908	.1944	5.145	.98163	
10	.0552	.0553	18.07	.99847	50	10	.1937	.1974	5.066	.98107	
20	.0581	.0582	17.17	.99831	40	20	.1965	.2004	4.989	.98050	
30	.0610	.0612	16.35	.99813	30	30	.1994	.2035	4.915	.97992	
40	.0640	.0641	15.60	.99795	20	40	.2022	.2065	4.843	.97934	
50	.0669	.0670	14.92	.99776	10	50	.2051	.2095	4.773	.97875	
4	.0698	.0699	14.30	.99756	86	12	.2079	.2126	4.705	.97815	
10	.0727	.0729	13.73	.99736	50	10	.2108	.2156	4.638	.97754	
20	.0756	.0758	13.20	.99714	40	20	.2136	.2186	4.574	.97692	
30	.0785	.0787	12.71	.99692	30	30	.2164	.2217	4.511	.97630	
40	.0814	.0816	12.25	.99668	20	40	.2193	.2247	4.449	.97566	
50	.0843	.0846	11.83	.99644	10	50	.2221	.2278	4.390	.97502	
5	.0872	.0875	11.43	.99619	85	13	.2250	.2309	4.331	.97437	
10	.0901	.0904	11.06	.99594	50	10	.2278	.2339	4.275	.97371	
20	.0929	.0934	10.71	.99567	40	20	.2306	.2370	4.219	.97304	
30	.0958	.0963	10.39	.99540	30	30	.2334	.2401	4.165	.97237	
40	.0987	.0992	10.08	.99511	20	40	.2363	.2432	4.113	.97169	
50	.1016	.1022	9.788	.99482	10	50	.2391	.2462	4.061	.97100	
6	.1045	.1051	9.514	.99452	84	14	.2419	.2493	4.011	.97030	
10	.1074	.1080	9.255	.99421	50	10	.2447	.2524	3.962	.96959	
20	.1103	.1110	9.010	.99390	40	20	.2476	.2555	3.914	.96887	
30	.1132	.1139	8.777	.99357	30	30	.2504	.2586	3.867	.96815	
40	.1161	.1169	8.556	.99324	20	40	.2532	.2617	3.821	.96742	
50	.1190	.1198	8.345	.99290	10	50	.2560	.2648	3.776	.96667	
7	.1219	.1228	8.144	.99255	83	15	.2588	.2679	3.732	.96593	
10	.1248	.1257	7.953	.99219	50	10	.2616	.2711	3.689	.96517	
20	.1276	.1287	7.770	.99182	40	20	.2644	.2742	3.647	.96440	
30	.1305	.1317	7.596	.99144	30	30	.2672	.2773	3.606	.96363	
40	.1334	.1346	7.429	.99106	20	40	.2700	.2805	3.566	.96285	
50	.1363	.1376	7.269	.99067	10	50	.2728	.2836	3.526	.96206	
				82						74	
	Cosin.	Cotg.	Tan.	Sine.	Angle.		Cosin.	Cotg.	Tan.	Sine.	Angle.

TABLE VIII.—NATURAL TRIGONOMETRICAL FUNCTIONS.

Angle	Sine.	Tan.	Cotg.	Cosin.		Angle	Sine.	Tan.	Cotg.	Cosin.	
<i>or</i> 16	.2756	.2867	3.487	.96126		<i>or</i> 24	.4067	.4452	2.246	.91355	
10	.2784	.2899	3.450	.96046	74	10	.4094	.4487	2.229	.91236	
20	.2812	.2931	3.412	.95964	50	20	.4120	.4522	2.211	.91116	
30	.2840	.2962	3.376	.95882	40	30	.4147	.4557	2.194	.90996	
40	.2868	.2994	3.340	.95799	30	40	.4173	.4592	2.177	.90875	
50	.2896	.3026	3.305	.95715	20	50	.4200	.4628	2.161	.90753	
					10						
17	.2924	.3057	3.271	.95615	73	25	.4226	.4663	2.145	.90631	
10	.2952	.3089	3.237	.95545	50	10	.4253	.4699	2.128	.90507	
20	.2979	.3121	3.204	.95459	40	20	.4279	.4734	2.112	.90383	
30	.3007	.3153	3.172	.95372	30	30	.4305	.4770	2.097	.90259	
40	.3035	.3185	3.140	.95284	20	40	.4331	.4806	2.081	.90133	
50	.3062	.3217	3.108	.95195	10	50	.4358	.4841	2.066	.90007	
18	.3090	.3249	3.078	.95106	72	26	.4384	.4877	2.050	.89879	
10	.3118	.3281	3.048	.95015	50	10	.4410	.4913	2.035	.89752	
20	.3145	.3314	3.018	.94924	40	20	.4436	.4950	2.020	.89623	
30	.3173	.3346	2.989	.94832	30	30	.4462	.4986	2.006	.89493	
40	.3201	.3378	2.960	.94740	20	40	.4488	.5022	1.991	.89363	
50	.3228	.3411	2.932	.94646	10	50	.4514	.5059	1.977	.89232	
19	.3256	.3443	2.904	.94552	71	27	.4540	.5095	1.963	.89101	
10	.3283	.3476	2.877	.94457	50	10	.4566	.5132	1.949	.88968	
20	.3311	.3508	2.850	.94361	40	20	.4592	.5169	1.935	.88835	
30	.3338	.3541	2.824	.94264	30	30	.4617	.5206	1.921	.88701	
40	.3365	.3574	2.798	.94167	20	40	.4643	.5243	1.907	.88566	
50	.3393	.3607	2.773	.94068	10	50	.4669	.5280	1.894	.88431	
20	.3420	.3640	2.747	.93969	70	28	.4695	.5317	1.881	.88295	
10	.3448	.3673	2.723	.93869	50	10	.4720	.5354	1.868	.88158	
20	.3475	.3706	2.699	.93769	40	20	.4746	.5392	1.855	.88020	
30	.3502	.3739	2.675	.93667	30	30	.4772	.5430	1.842	.87882	
40	.3529	.3772	2.651	.93565	20	40	.4797	.5467	1.829	.87743	
50	.3557	.3805	2.628	.93462	10	50	.4823	.5505	1.816	.87603	
21	.3584	.3839	2.605	.93358	69	29	.4848	.5543	1.804	.87462	
10	.3611	.3872	2.583	.93253	50	10	.4874	.5581	1.792	.87321	
20	.3638	.3906	2.560	.93148	40	20	.4899	.5619	1.780	.87178	
30	.3665	.3939	2.539	.93042	30	30	.4924	.5658	1.767	.87036	
40	.3692	.3973	2.517	.92935	20	40	.4950	.5696	1.756	.86892	
50	.3719	.4006	2.496	.92827	10	50	.4975	.5735	1.744	.86748	
22	.3746	.4040	2.475	.92718	68	30	.5000	.5774	1.732	.86603	
10	.3773	.4074	2.455	.92609	50	10	.5025	.5812	1.720	.86457	
20	.3800	.4108	2.434	.92499	40	20	.5050	.5851	1.709	.86310	
30	.3827	.4142	2.414	.92388	30	30	.5075	.5890	1.698	.86163	
40	.3854	.4176	2.394	.92276	20	40	.5100	.5930	1.686	.86015	
50	.3881	.4210	2.375	.92164	10	50	.5125	.5969	1.675	.85866	
23	.3907	.4245	2.356	.92050	67	31	.5150	.6009	1.664	.85717	
10	.3934	.4279	2.337	.91936	50	10	.5175	.6048	1.653	.85567	
20	.3961	.4314	2.318	.91822	40	20	.5200	.6088	1.643	.85416	
30	.3987	.4348	2.300	.91706	30	30	.5225	.6128	1.632	.85264	
40	.4014	.4383	2.282	.91590	20	40	.5250	.6168	1.621	.85112	
50	.4041	.4417	2.264	.91472	10	50	.5275	.6208	1.611	.84959	
					66						
										58	
	Cosin.	Cotg.	Tan.	Sine.	Angle.		Cosin.	Cotg.	Tan.	Sine.	Angle.

TABLE VIII.—NATURAL TRIGONOMETRICAL FUNCTIONS.

Angle	Sine.	Tan.	Cotg.	Cosin.		Angle	Sine.	Tan.	Cotg.	Cosin.	
32	.5299	.6249	1.600	.84805	58	30	.6225	.7954	1.257	.78261	30
10	.5324	.6289	1.590	.84650	50	40	.6248	.8002	1.250	.78079	20
20	.5348	.6330	1.580	.84495	40	50	.6271	.8050	1.242	.77897	10
30	.5373	.6371	1.570	.84339	30	39	.6293	.8098	1.235	.77715	51
40	.5398	.6412	1.560	.84182	20	10	.6316	.8146	1.228	.77531	50
50	.5422	.6453	1.550	.84025	10	20	.6338	.8195	1.220	.77347	40
33	.5446	.6494	1.540	.83867	57	30	.6361	.8243	1.213	.77162	30
10	.5471	.6536	1.530	.83708	50	40	.6383	.8292	1.206	.76977	20
20	.5495	.6577	1.520	.83549	40	50	.6406	.8342	1.199	.76791	10
30	.5519	.6619	1.511	.83389	30	40	.6428	.8391	1.192	.76604	50
40	.5544	.6661	1.501	.83228	20	10	.6450	.8441	1.185	.76417	50
50	.5568	.6703	1.492	.83066	10	20	.6472	.8491	1.178	.76229	40
34	.5592	.6745	1.483	.82904	56	30	.6494	.8541	1.171	.76041	30
10	.5616	.6787	1.473	.82741	50	40	.6517	.8591	1.164	.75851	20
20	.5640	.6830	1.464	.82577	40	50	.6539	.8642	1.157	.75661	10
30	.5664	.6873	1.455	.82413	30	41	.6561	.8693	1.150	.75471	49
40	.5688	.6916	1.446	.82248	20	10	.6583	.8744	1.144	.75280	50
50	.5712	.6959	1.437	.82082	10	20	.6604	.8796	1.137	.75088	40
35	.5736	.7002	1.428	.81915	55	30	.6626	.8847	1.130	.74896	30
10	.5760	.7046	1.419	.81748	50	40	.6648	.8899	1.124	.74703	20
20	.5783	.7089	1.411	.81580	40	50	.6670	.8952	1.117	.74509	10
30	.5807	.7133	1.402	.81412	30	42	.6691	.9004	1.111	.74314	48
40	.5831	.7177	1.393	.81242	20	10	.6713	.9057	1.104	.74120	50
50	.5854	.7221	1.385	.81072	10	20	.6734	.9110	1.098	.73924	40
36	.5878	.7265	1.376	.80902	54	30	.6756	.9163	1.091	.73728	30
10	.5901	.7310	1.368	.80730	50	40	.6777	.9217	1.085	.73531	20
20	.5925	.7355	1.360	.80558	40	50	.6799	.9271	1.079	.73333	10
30	.5948	.7400	1.351	.80386	30	43	.6820	.9325	1.072	.73135	47
40	.5972	.7445	1.343	.80212	20	10	.6841	.9380	1.066	.72937	50
50	.5995	.7490	1.335	.80038	10	20	.6862	.9435	1.060	.72737	40
37	.6018	.7536	1.327	.79864	53	30	.6884	.9490	1.054	.72537	30
10	.6041	.7581	1.319	.79688	50	40	.6905	.9545	1.048	.72337	20
20	.6065	.7627	1.311	.79512	40	50	.6926	.9601	1.042	.72136	10
30	.6088	.7673	1.303	.79335	30	44	.6947	.9657	1.036	.71934	46
40	.6111	.7720	1.295	.79158	20	10	.6967	.9713	1.030	.71732	50
50	.6134	.7766	1.288	.78980	10	20	.6988	.9770	1.024	.71529	40
38	.6157	.7813	1.280	.78801	52	30	.7009	.9827	1.018	.71325	30
10	.6180	.7860	1.272	.78622	50	40	.7030	.9884	1.012	.71121	20
20	.6202	.7907	1.265	.78442	40	50	.7050	.9942	1.006	.70916	10
							.7071	1.	1.	.70711	45
											or
	Cosin.	Cotg.	Tan.	Sine.	Angle.		Cosin.	Cotg.	Tan.	Sine.	Angle.

TABLE IX.—CALCULATION OF EARTHWORK.

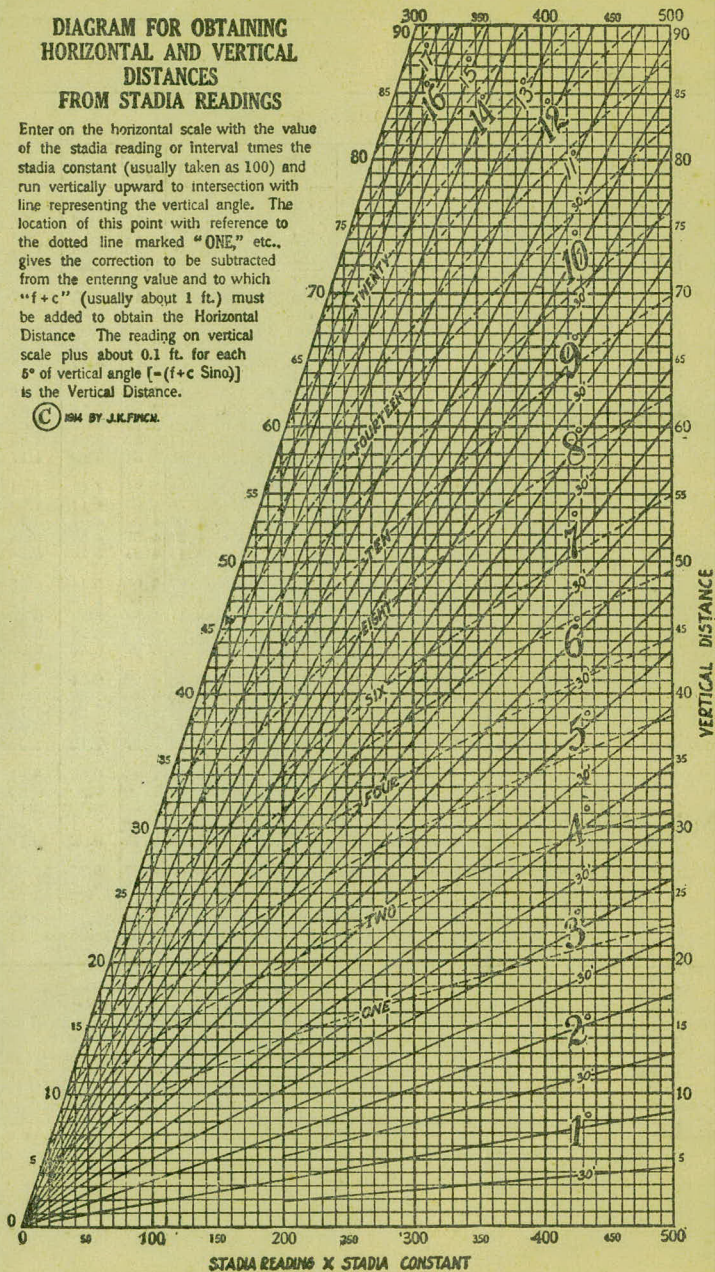
Width	HEIGHT														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	.02	.04	.06	.07	.09	.11	.13	.15	.17	.18	.20	.22	.24	.26	.28
2	.04	.07	.11	.15	.18	.22	.26	.30	.33	.37	.41	.44	.48	.52	.56
3	.06	.11	.17	.22	.28	.33	.39	.44	.50	.56	.61	.67	.72	.78	.83
4	.07	.15	.22	.30	.37	.44	.52	.59	.67	.74	.81	.89	.96	1.04	1.11
5	.09	.19	.28	.37	.46	.56	.65	.74	.83	.93	1.02	1.11	1.20	1.30	1.39
6	.11	.22	.33	.44	.56	.67	.78	.89	1.00	1.11	1.22	1.33	1.44	1.55	1.67
7	.13	.26	.39	.52	.65	.78	.91	1.04	1.16	1.30	1.42	1.55	1.68	1.81	1.94
8	.15	.30	.44	.59	.74	.89	1.04	1.19	1.33	1.48	1.63	1.78	1.92	2.08	2.22
9	.17	.33	.50	.67	.83	1.00	1.17	1.33	1.50	1.67	1.83	2.00	2.17	2.33	2.50
10	.18	.37	.56	.74	.93	1.11	1.30	1.48	1.67	1.85	2.04	2.22	2.41	2.59	2.78
11	.20	.41	.61	.82	1.02	1.22	1.43	1.63	1.83	2.04	2.24	2.44	2.65	2.85	3.06
12	.22	.44	.67	.89	1.11	1.33	1.56	1.78	2.00	2.22	2.44	2.67	2.89	3.11	3.33
13	.24	.48	.72	.96	1.20	1.44	1.68	1.92	2.16	2.41	2.65	2.89	3.13	3.37	3.61
14	.26	.52	.78	1.04	1.30	1.55	1.81	2.08	2.33	2.59	2.85	3.11	3.37	3.63	3.89
15	.28	.56	.83	1.11	1.39	1.67	1.94	2.22	2.50	2.78	3.06	3.33	3.61	3.89	4.17
16	.30	.59	.89	1.18	1.48	1.78	2.07	2.37	2.67	2.96	3.26	3.56	3.85	4.15	4.44
17	.31	.63	.94	1.26	1.57	1.89	2.20	2.52	2.83	3.15	3.46	3.78	4.09	4.41	4.72
18	.33	.67	1.00	1.33	1.67	2.00	2.33	2.67	3.00	3.33	3.67	4.00	4.33	4.67	5.00
19	.35	.70	1.06	1.41	1.76	2.11	2.46	2.82	3.17	3.52	3.87	4.22	4.57	4.92	5.28
20	.37	.74	1.11	1.48	1.85	2.22	2.59	2.96	3.33	3.70	4.07	4.44	4.81	5.18	5.56
21	.39	.78	1.17	1.55	1.94	2.33	2.72	3.11	3.50	3.89	4.28	4.67	5.06	5.44	5.83
22	.41	.81	1.22	1.63	2.04	2.44	2.85	3.26	3.67	4.07	4.48	4.89	5.30	5.70	6.11
23	.43	.85	1.28	1.70	2.13	2.56	2.98	3.41	3.83	4.26	4.68	5.11	5.54	5.96	6.39
24	.44	.89	1.33	1.78	2.22	2.67	3.11	3.56	4.00	4.44	4.89	5.33	5.78	6.22	6.67
25	.46	.92	1.39	1.85	2.31	2.78	3.24	3.70	4.17	4.63	5.09	5.56	6.02	6.48	6.94
26	.48	.96	1.44	1.92	2.41	2.89	3.37	3.85	4.33	4.82	5.30	5.78	6.26	6.74	7.24
27	.50	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50	5.00	5.50	6.00	6.50	7.00	7.50
28	.52	1.04	1.55	2.07	2.59	3.11	3.63	4.15	4.67	5.18	5.70	6.22	6.74	7.26	7.78
29	.54	1.07	1.61	2.15	2.68	3.22	3.76	4.30	4.83	5.37	5.91	6.44	6.98	7.52	8.06
30	.56	1.11	1.67	2.22	2.78	3.33	3.89	4.44	5.00	5.55	6.11	6.67	7.22	7.78	8.33
31	.57	1.15	1.72	2.30	2.87	3.44	4.02	4.59	5.17	5.74	6.32	6.89	7.46	8.04	8.61
32	.59	1.18	1.78	2.37	2.96	3.56	4.15	4.74	5.33	5.92	6.52	7.11	7.70	8.30	8.89
33	.61	1.22	1.83	2.44	3.05	3.67	4.28	4.89	5.50	6.11	6.72	7.33	7.94	8.55	9.17
34	.63	1.26	1.89	2.52	3.15	3.78	4.40	5.04	5.67	6.29	6.93	7.56	8.18	8.81	9.44
35	.65	1.30	1.94	2.59	3.24	3.89	4.53	5.18	5.83	6.48	7.13	7.78	8.42	9.08	9.72
36	.67	1.33	2.00	2.67	3.33	4.00	4.66	5.33	6.00	6.67	7.33	8.00	8.67	9.33	10.00
37	.68	1.37	2.06	2.74	3.42	4.11	4.79	5.48	6.17	6.85	7.54	8.22	8.91	9.59	10.28
38	.70	1.41	2.11	2.82	3.52	4.22	4.92	5.63	6.33	7.03	7.74	8.44	9.15	9.85	10.56
39	.72	1.44	2.17	2.89	3.61	4.33	5.05	5.78	6.50	7.22	7.95	8.67	9.39	10.11	10.83
40	.74	1.48	2.22	2.96	3.70	4.44	5.18	5.92	6.67	7.41	8.15	8.89	9.63	10.37	11.11

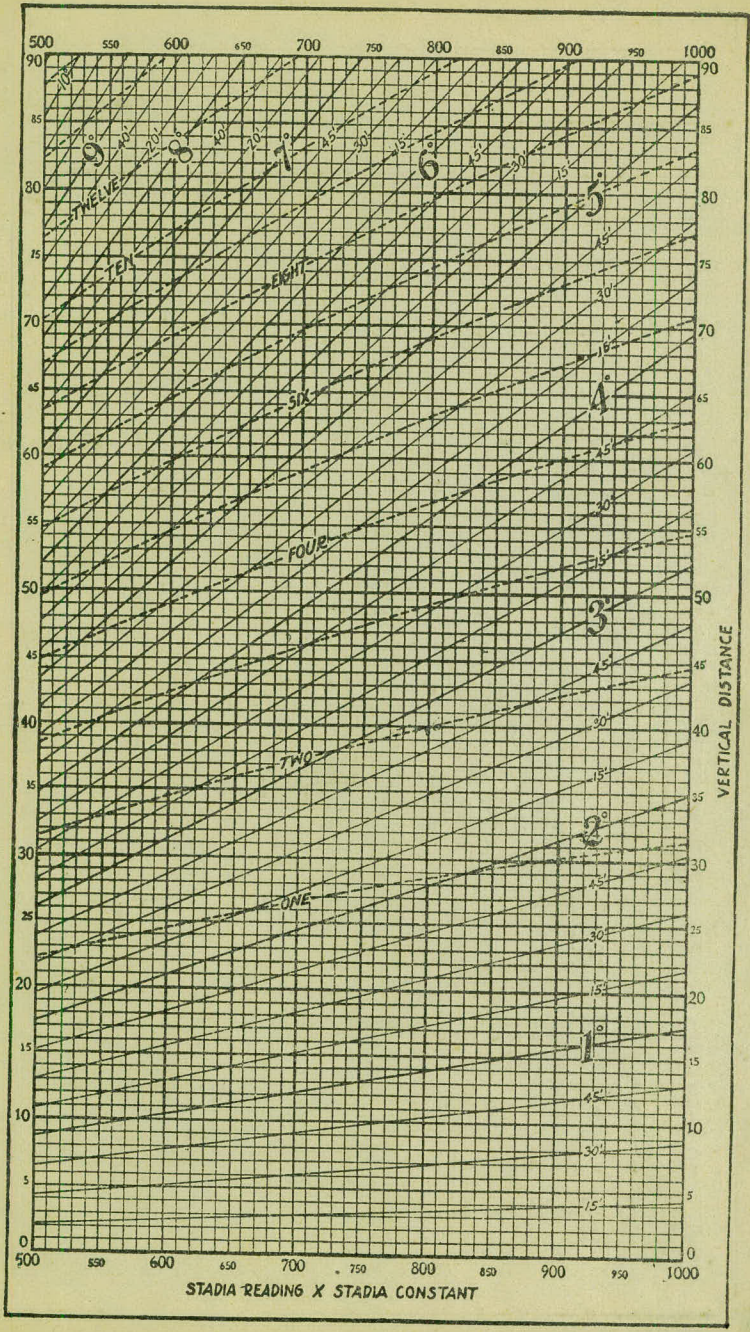
Table gives cu. yds. in 1 ft. of a triangle of given width and height. Corrections for tenths of width are one tenth the values found under each height considering the widths from 1 to 9 as tenths and similarly the corrections for tenths of height are one tenth the figures opposite width considering the heights from 1 to 9 as tenths. Thus if $w = 16.2$ and $h = 5.3$, cu. yds. $= 1.43 + .028 - .039 = 1.597$ cu. yds. or practically 160 cu. yds. per 100 ft. If w exceeds 40 ft., use one half and multiply result by 2, if both w and h are large use one half of each and multiply result by 4. Any cross-section may be divided into triangles by the following rule. To the triangle of the sum of the outside cuts (or fills) $= h$, and $\frac{1}{2}$ the roadbed $= w$, add the triangles formed by taking the distance out to each break in turn ($= w$'s) by the difference between the cuts (or fills) on each side of it ($= h$'s) always subtracting the outer from the inner.

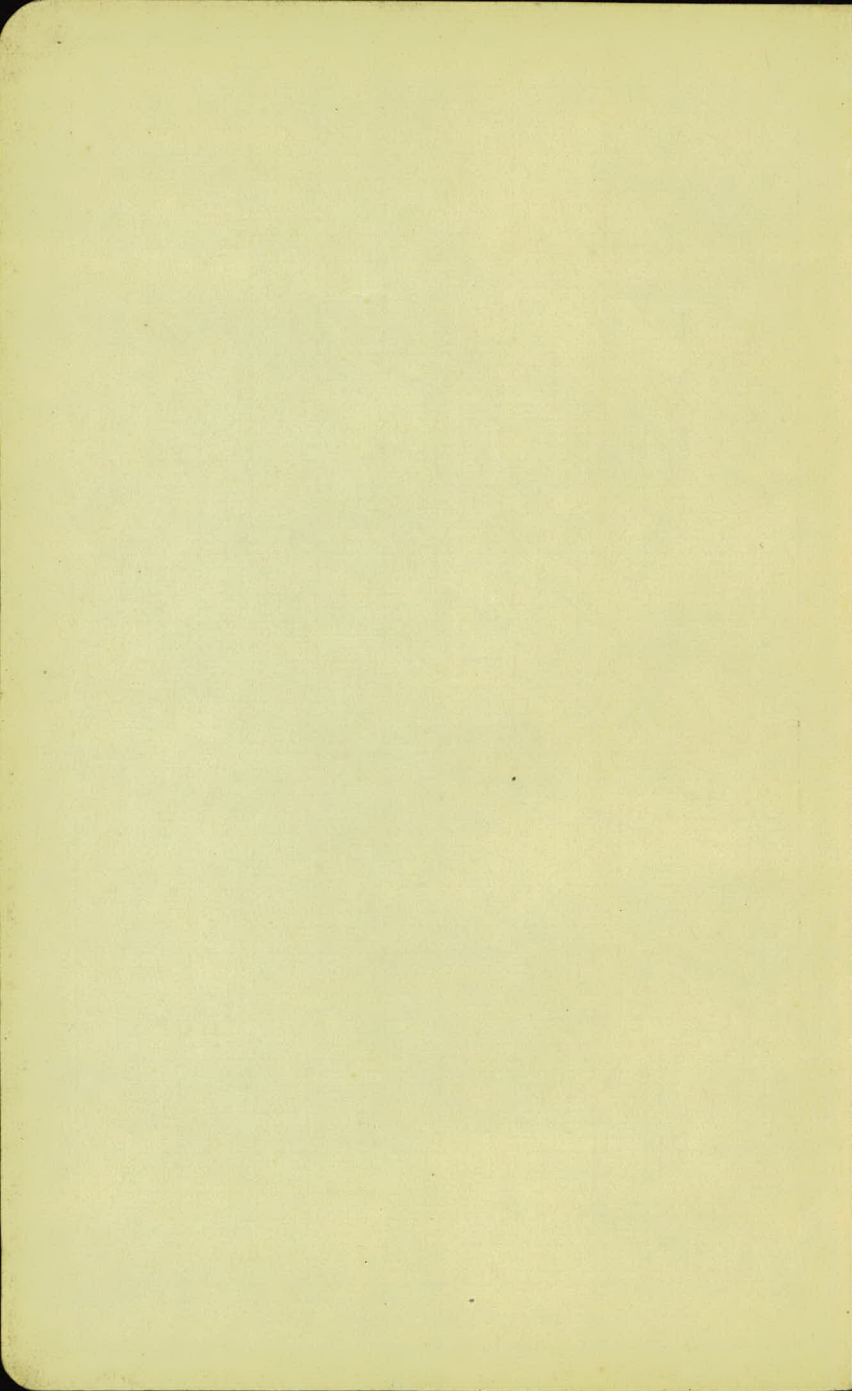
DIAGRAM FOR OBTAINING HORIZONTAL AND VERTICAL DISTANCES FROM STADIA READINGS

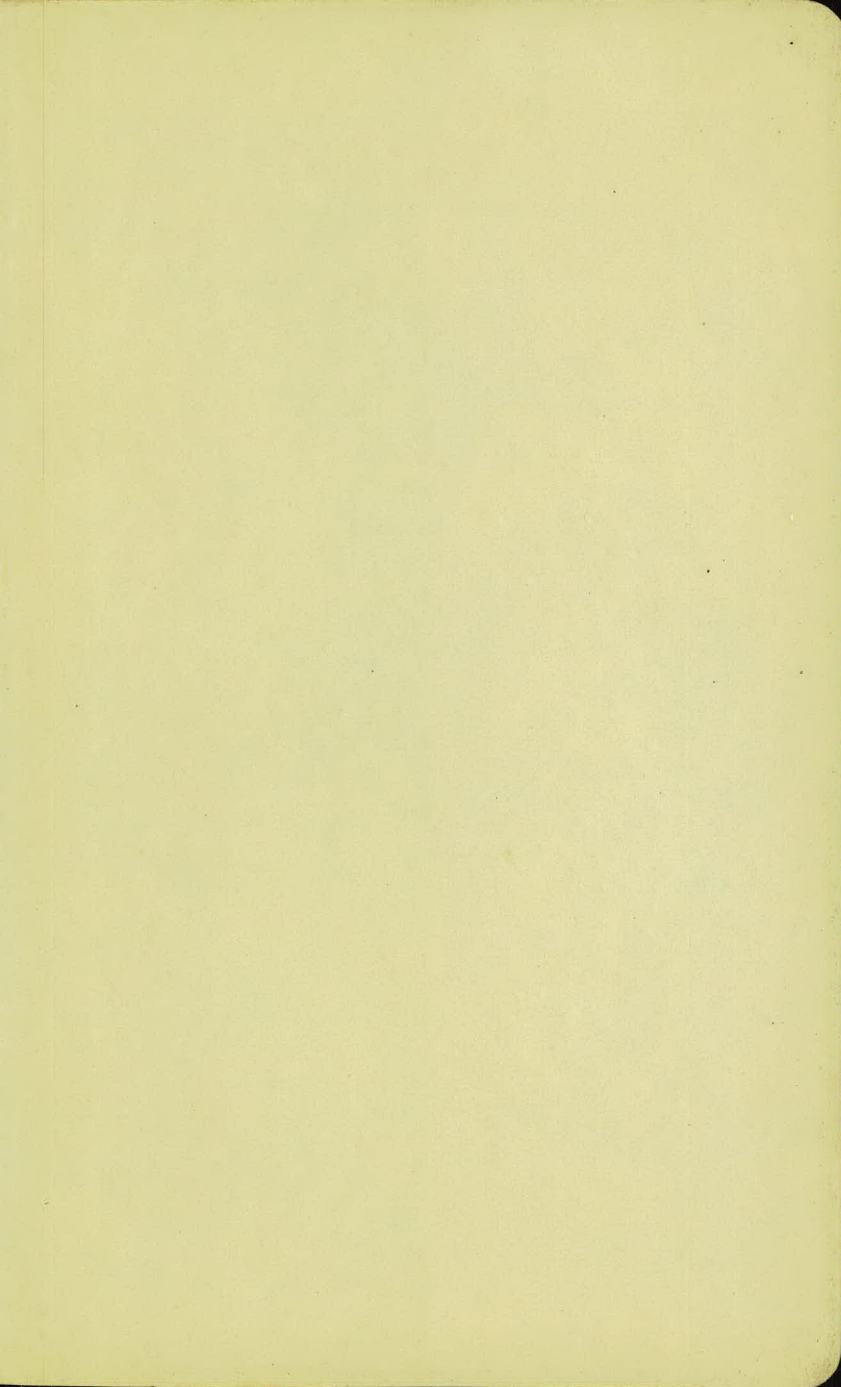
Enter on the horizontal scale with the value of the stadia reading or interval times the stadia constant (usually taken as 100) and run vertically upward to intersection with line representing the vertical angle. The location of this point with reference to the dotted line marked "ONE," etc., gives the correction to be subtracted from the entering value and to which " $f+c$ " (usually about 1 ft.) must be added to obtain the Horizontal Distance. The reading on vertical scale plus about 0.1 ft. for each 5° of vertical angle [$=(f+c \text{ Sino})$] is the Vertical Distance.

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13 + 75

127584
1 1932
0+56.52
2418
27498

45

36.18

1003.40
88.

52
5
4
8
75
1697
97
15.0091

89
3
60)269
240
29

1003 40
16 97

1020 37
0020
40 27
40 17

3.1416

30
4)942480
4
14
12
22
20

10

160

3.1416
70

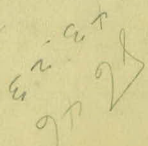
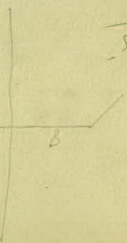
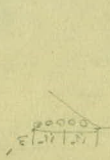
90.99

4)1256640
12
5
31

91

18°34'

3



02482

18 5667
612

371334
5667

11 1 8 4 0 0 2 0 4
113628204

34.0884412

11.50
105
1255

9-17

4-38-5

2 19

2-34
2 1 9

4.5 3
2 1 9

6.7 2

7-12
2 1 9

3 1
2 1 9 0 4

9-31
2 1 9
11 5 0

553
2 1 9
6 1 2

11-50
3 4
11 8 6

12-24

11 8 2

25-50
12-30

Sta. Point. ang. Lt. ang. Rt. Cal. Bear.

11+61 49 P.T. 12-55

+50 11-50

+25 9-31

11+00 7-12

+75 4-53

+50 2-34

10+22 37 P.C. 0-00

William
Spiegel
Alexander

Note = This Curve was run on
the shoulder line

$$A = 25^{\circ} 50'$$

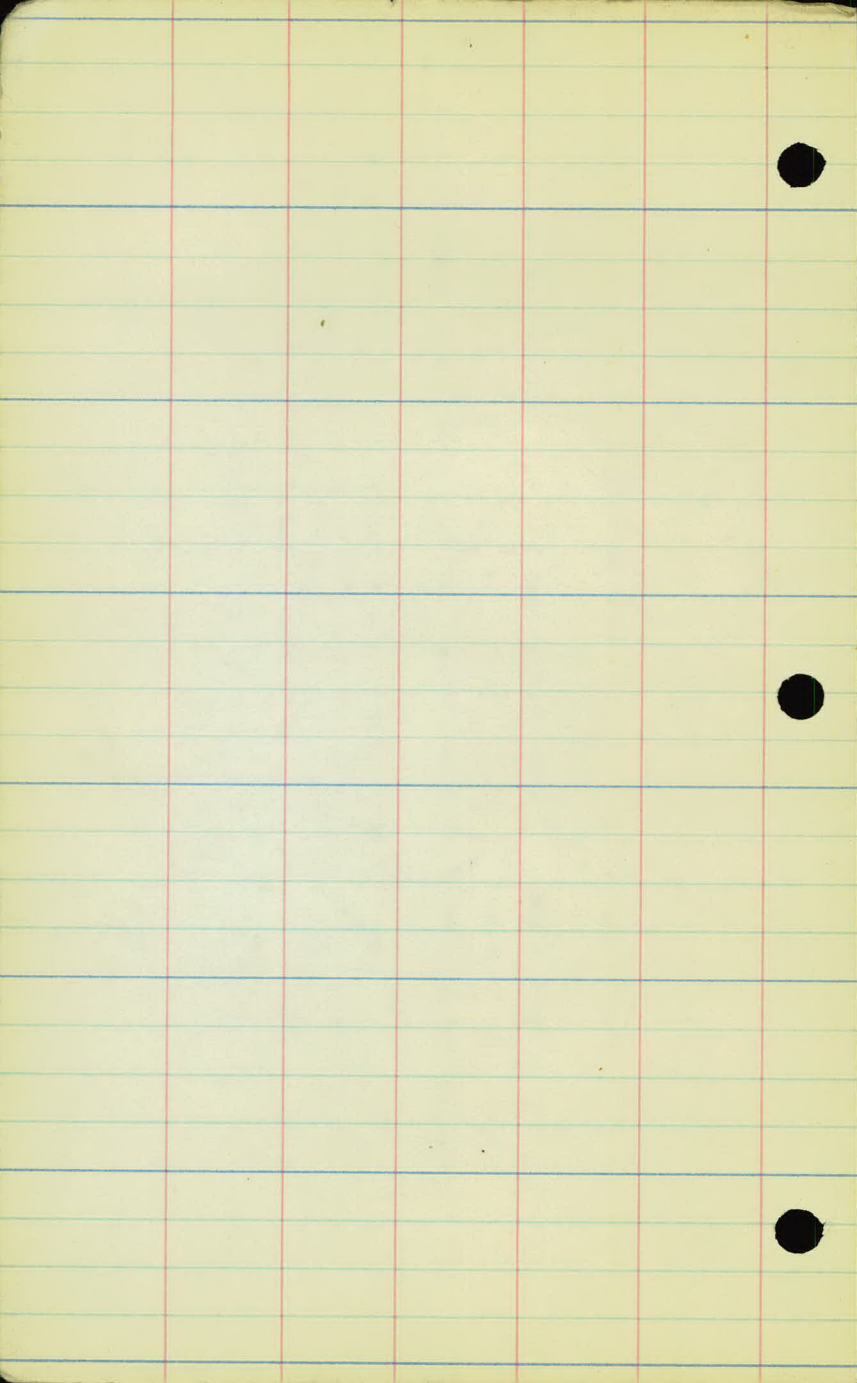
$$D = 18^{\circ} 34'$$

$$TAN. = 71.08$$

$$Lang = 139.16$$

$$Rad. = 309.95$$

$$P.I. = 10493.45$$



$$\begin{array}{r} 25.1 \\ 8 \\ \hline 200.8 \\ .3 \\ \hline 60.24 \end{array}$$

$$\begin{array}{r} 18.35 \\ 5.21 \\ \hline 93.56 \\ 3.45 \\ \hline 90.10 \end{array}$$

$$\begin{array}{r} 21008.7 \\ 1000.44 \\ \hline 220089.4 \end{array}$$

$$\begin{array}{r} 93.56 \\ 5.3 \\ \hline 98.16 = \text{Gr. sta } 2+33 \end{array}$$

$$\begin{array}{r} 93.56 \\ 7.3 \\ \hline 86.26 = \text{Gr. } 25' \text{ ht. } 2+33 \end{array}$$

$$\begin{array}{r} 93.56 \\ 3.5 \\ \hline 90.06 = \text{Gr. } 78' \text{ ht. } 5+75 \end{array}$$

B.M. 88.35

$$\begin{array}{r} 5170 \\ 23 \\ \hline 5490 \end{array}$$

Sta.	T	H.I.	-	Red.	Elev.
B.M.	0.64	111.44		110.80	
0+30 ^E				9.7	101.9
0+36 ^E				9.4	102.0
0+56 ⁵⁴				9.1	102.3
0+75				9.7	101.7
T.P.	1.02	103.85	8.61	102.83	
1+00				2.8	101.1
+04				3.4	100.5
+19				12.2	91.7
T.P.	3.82	96.99	10.68	93.17	
+27				4.8	90.2
1+34				5.9	91.1
+44				8.0	89.0
+67				8.7	88.3
+69				6.9	90.1
2+00				8.1	88.9

H.

RT.

Tape of Hyd. H. Sta. 5759

99	91	90		
33	14	11	9.7	→

95	95	100	9.9		90	
33	28	25	13	9.4	11	→

9.2	90	9.2		8.6	8.8	8.3	8.1	10.1
33	21	12	9.1	8	11	14	51	35

95	100	9.9	8.8		8.4	8.5	11.6
33	30	11	4	9.7	9	32	34

5.6	5.0	5.4	6.8	4.8	4.7		2.3	1.7	5.8	5.8
33	17	18	10	9	8	2.8	20	15	32	33

7.1	5.9	6.5	7.4	7.4	6.2		2.7	4.2	4.2	6.7	6.7
33	19	17	13	11	9	3.4	16	24	28	32	33

14.6	12.6	9.3			10.9	6.8	8.0	7.6
33	25	14	12.2		12	23	18	39

8.1	2.3	7.0			4.6	2.0	1.9
33	3.0	9	6.8		12	23	33

7.7	3.6	7.3	7.3		5.1	4.3	3.1	2.5
33	22	14	8	5.9	13	14	20	33

9.1	8.1	7.6	7.5		6.8	4.8	3.7	4.2
33	30	20	8	8.0	9	12	29	33

11.0	9.4				6.8	5.9	5.6
33	10	8.7			1	17	39

11.0	9.9	8.8			6.0	5.6
33	17	1	6.9		13	33

11.7	9.7				7.4	6.4
33	20	8.1			16	33

Sta.	T	H.I.	-	Red.	Elev.
		96.99			
2725				7.0	88.0
+50				8.5	88.7
+75				8.5	88.5
B.M.	2.33	94.44	4.84	92.13	92.13
+88				5.4	88.9
3700				4.4	89.9
+27				6.2	88.3
+50				6.4	87.9
B.M.			2.33	92.13	

Lt.

Rt.

$\frac{10.6}{33}$	$\frac{9.9}{28}$	$\frac{9.5}{17}$	9.0	$\frac{8.5}{7}$	$\frac{7.0}{29}$	$\frac{7.0}{33}$
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$\frac{11.2}{33}$	$\frac{8.7}{18}$	$\frac{9.3}{11}$	8.3	$\frac{8.7}{7}$	$\frac{7.3}{19}$	$\frac{7.1}{29}$
-------------------	------------------	------------------	-----	-----------------	------------------	------------------

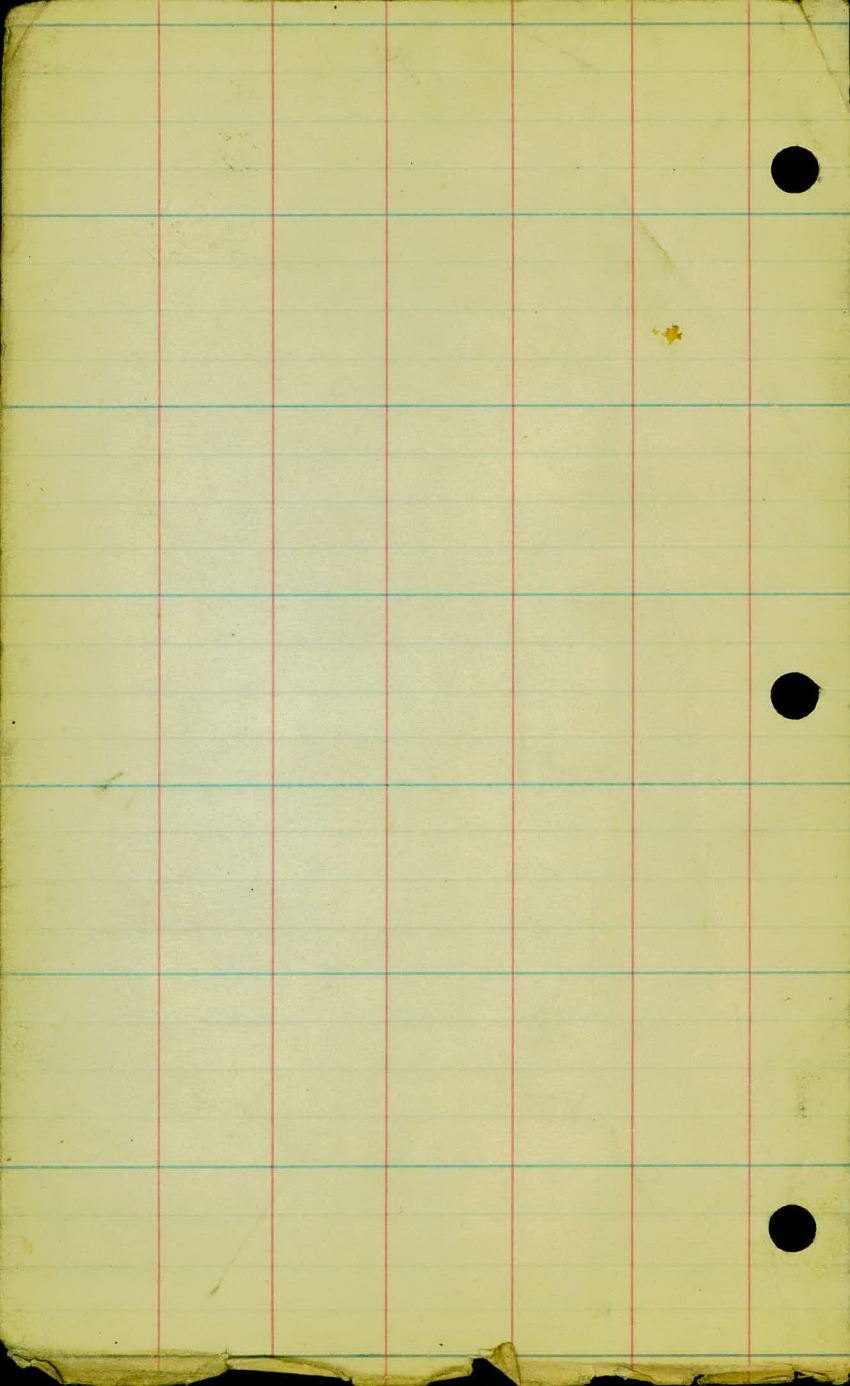
$\frac{11.2}{33}$	$\frac{11.2}{31}$	$\frac{9.5}{22}$	8.5	$\frac{7.1}{14}$	$\frac{6.7}{31}$
-------------------	-------------------	------------------	-----	------------------	------------------

$\frac{8.4}{33}$	$\frac{7.7}{27}$	$\frac{6.7}{10}$	5.6	$\frac{4.6}{11}$	$\frac{4.0}{31}$
------------------	------------------	------------------	-----	------------------	------------------

$\frac{8.7}{33}$	$\frac{7.6}{24}$	$\frac{7.0}{15}$	4.4	$\frac{3.9}{7}$	$\frac{4.8}{22}$	$\frac{5.2}{31}$
------------------	------------------	------------------	-----	-----------------	------------------	------------------

$\frac{7.7}{33}$	$\frac{6.9}{23}$	$\frac{6.9}{14}$	6.2	$\frac{6.5}{19}$	$\frac{6.7}{31}$
------------------	------------------	------------------	-----	------------------	------------------

$\frac{7.4}{33}$	$\frac{6.9}{19}$	6.4	$\frac{6.7}{17}$	$\frac{7.0}{31}$
------------------	------------------	-----	------------------	------------------



$$\begin{array}{r} 91.96 \\ .18 \\ \hline 9214 \\ 9940 \\ \hline .74 \\ 50 \\ \hline .2 \end{array}$$

$$\begin{array}{r} 101.10 \\ 914 \\ \hline 9196 \\ \hline 210 \\ \hline 101.10 \\ 914 \\ \hline 9196 \\ \hline 0 \end{array}$$

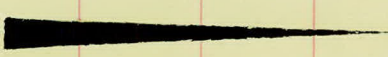
$$\begin{array}{r} 92.1 \\ 899 \\ \hline 2.2 \\ \hline 25 \end{array}$$

$$\begin{array}{r} 30 \\ 12 \\ \hline 18 \\ \hline 11 \end{array}$$

$$\begin{array}{r} 18 \\ 9 \\ \hline 27 \\ \hline 10 \end{array}$$

$$\begin{array}{r} 8 \\ 9 \\ \hline 17 \end{array}$$

$$\begin{array}{r} 92.1 \\ 899 \\ \hline 2.2 \\ \hline 25 \end{array}$$



$$\begin{array}{r} 2.8 \\ 5 \\ \hline 12.8 \end{array}$$

$$\begin{array}{r} 8 \\ 10 \\ \hline 18 \\ \hline 27 \\ \hline 37 \end{array}$$

$$\begin{array}{r} 10.10 \\ 10 \\ \hline 0 \end{array}$$

$$\begin{array}{r} 100 \\ 100 \\ \hline 200 \end{array}$$

$$\begin{array}{r} 9 \\ 9 \\ \hline 18 \end{array}$$

$$\begin{array}{r} 10.10 \\ 2.2 \\ \hline 12.3 \\ \hline 12.0 \\ \hline 0.3 \end{array}$$

22

$$\begin{array}{r} 6.2 \\ 5 \\ \hline 11.2 \end{array}$$

11
611

101.10 H.1.

106.47
317

109.64
580

109.64

3.84

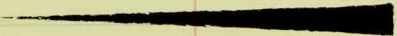
108.94
66

109.60 H.I.
W

11.0
27
137

109.60
99
10.20
18
1.5
8.5
7.5
8.5
8.5

27
13
40
09.60
1
8.6



109.60
1068
98.92
218

1068
9892
109.60

101.10
974
3.7

74
32
42
21
63

68
51
93
26
119

37
52

18
19
27

13
10
23
46
59

0
0
0.0

$$\begin{array}{r} 0875 \\ 327 \\ \hline 48 \\ 5 \end{array}$$

$$\begin{array}{r} 108.75 \\ 401 \\ \hline 5.74 \end{array}$$

$$\begin{array}{r} 106.47 \\ 228 \\ \hline 108754.1 \end{array}$$

$$\begin{array}{r} 875 \\ 330 \\ \hline 5.4 \\ \hline 875 \end{array}$$

$$\begin{array}{r} 8.75 \\ 380 \\ \hline 4.95 \end{array}$$

$$\begin{array}{r} 875 \\ 360 \\ \hline 5.15 \end{array}$$

$$\begin{array}{r} 875 \\ 0840 \\ \hline 3.13 \\ 5 \end{array}$$

$$\begin{array}{r} 875 \\ 80 \\ \hline 3.95 \\ 4 \end{array}$$

$$\begin{array}{r} 875 \\ 348 \\ \hline 5 \end{array}$$

$$\begin{array}{r} 875 \\ 2015 \\ \hline 4 \end{array}$$

$$\begin{array}{r} 08.41 \\ 330 \\ \hline 5.11 \end{array}$$

$$\begin{array}{r} 108.75 \\ 495 \\ \hline \end{array}$$

$$\begin{array}{r} 103.80 \\ 461 \\ \hline \end{array}$$

$$\begin{array}{r} 8.41 \\ 420 \\ \hline 4.21 \end{array}$$

$$\begin{array}{r} 108.41 \\ \hline \end{array}$$

$$\begin{array}{r} 92.7 \\ 89.4 \\ \hline 2.8 \end{array}$$

$$\begin{array}{r} 88.35 \\ 389 \\ \hline 92.24 \end{array}$$

92.2

$$\begin{array}{r} 92.2 \\ 89.4 \\ \hline 2.8 \\ 3+00 \end{array}$$

$$\begin{array}{r} 18.00 \\ 5.274 \\ \hline 12.726 \end{array}$$

25.06
12.33

Distances From Center of Roadway

**DISTANCES FROM CENTER OF ROADWAY FOR
CROSS-SECTIONING.**

Roadway 16 feet wide. Side Slopes 1 on 1½.
For Single Track Embankment.

H	0	.1	.2	.3	.4	.5	.6	.7	.8	.9	H
0	8.0	8.2	8.3	8.5	8.6	8.8	8.9	9.1	9.2	9.4	0
1	9.5	9.7	9.8	10.0	10.1	10.3	10.4	10.6	10.7	10.9	1
2	11.0	11.2	11.3	11.5	11.6	11.8	11.9	12.1	12.2	12.4	2
3	12.5	12.7	12.8	13.0	13.1	13.3	13.4	13.6	13.7	13.9	3
4	14.0	14.2	14.3	14.5	14.6	14.8	14.9	15.1	15.2	15.4	4
5	15.5	15.7	15.8	16.0	16.1	16.3	16.4	16.6	16.7	16.9	5
6	17.0	17.2	17.3	17.5	17.6	17.8	17.9	18.1	18.2	18.4	6
7	18.5	18.7	18.8	19.0	19.1	19.3	19.4	19.6	19.7	19.9	7
8	20.0	20.2	20.3	20.5	20.6	20.8	20.9	21.1	21.2	21.4	8
9	21.5	21.7	21.8	22.0	22.1	22.3	22.4	22.6	22.7	22.9	9
10	23.0	23.2	23.3	23.5	23.6	23.8	23.9	24.1	24.2	24.4	10
11	24.5	24.7	24.8	25.0	25.1	25.3	25.4	25.6	25.7	25.9	11
12	26.0	26.2	26.3	26.5	26.6	26.8	26.9	27.1	27.2	27.4	12
13	27.5	27.7	27.8	28.0	28.1	28.3	28.4	28.6	28.7	28.9	13
14	29.0	29.2	29.3	29.5	29.6	29.8	29.9	30.1	30.2	30.4	14
15	30.5	30.7	30.8	31.0	31.1	31.3	31.4	31.6	31.7	31.9	15
16	32.0	32.2	32.3	32.5	32.6	32.8	32.9	33.1	33.2	33.4	16
17	33.5	33.7	33.8	34.0	34.1	34.3	34.4	34.6	34.7	34.9	17
18	35.0	35.2	35.3	35.5	35.6	35.8	35.9	36.1	36.2	36.4	18
19	36.5	36.7	36.8	37.0	37.1	37.3	37.4	37.6	37.7	37.9	19
20	38.0	38.2	38.3	38.5	38.6	38.8	38.9	39.1	39.2	39.4	20
21	39.5	39.7	39.8	40.0	40.1	40.3	40.4	40.6	40.7	40.9	21
22	41.0	41.2	41.3	41.5	41.6	41.8	41.9	42.1	42.2	42.4	22
23	42.5	42.7	42.8	43.0	43.1	43.3	43.4	43.6	43.7	43.9	23
24	44.0	44.2	44.3	44.5	44.6	44.8	44.9	45.1	45.2	45.4	24
25	45.5	45.7	45.8	46.0	46.1	46.3	46.4	46.6	46.7	46.9	25
26	47.0	47.2	47.3	47.5	47.6	47.8	47.9	48.1	48.2	48.4	26
27	48.5	48.7	48.8	49.0	49.1	49.3	49.4	49.6	49.7	49.9	27
28	50.0	50.2	50.3	50.5	50.6	50.8	50.9	51.1	51.2	51.4	28
29	51.5	51.7	51.8	52.0	52.1	52.3	52.4	52.6	52.7	52.9	29
30	53.0	53.2	53.3	53.5	53.6	53.8	53.9	54.1	54.2	54.4	30
31	54.5	54.7	54.8	55.0	55.1	55.3	55.4	55.6	55.7	55.9	31
32	56.0	56.2	56.3	56.5	56.6	56.8	56.9	57.1	57.2	57.4	32
33	57.5	57.7	57.8	58.0	58.1	58.3	58.4	58.6	58.7	58.9	33
34	59.0	59.2	59.3	59.5	59.6	59.8	59.9	60.1	60.2	60.4	34
35	60.5	60.7	60.8	61.0	61.1	61.3	61.4	61.6	61.7	61.9	35
36	62.0	62.2	62.3	62.5	62.6	62.8	62.9	63.1	63.2	63.4	36
37	63.5	63.7	63.8	64.0	64.1	64.3	64.4	64.6	64.7	64.9	37
38	65.0	65.2	65.3	65.5	65.6	65.8	65.9	66.1	66.2	66.4	38
39	66.5	66.7	66.8	67.0	67.1	67.3	67.4	67.6	67.7	67.9	39
40	68.0	68.2	68.3	68.5	68.6	68.8	68.9	69.1	69.2	69.4	40

Example—If point is 22.6 ft. above grade, how far should it be from center line to be a slope stake point? Ans. from Table 41.9. For same slopes but other widths of roadbed correct above figures by one-half difference in width of roadbed; thus in example above for 20 ft. roadbed distance will be $41.9 + (20 - 16) \div 2$ or 2 ft. added to 41.9 = 43.9. For slopes of 1 on 1 see inside of front cover.